REPORT RESUMES

ED 019 755 24 EA 001 350

INSTRUCTIONAL USES OF SIMULATION--A SELECTED BIBLIOGRAPHY.
BY- TWELKER, PAUL A. WALLEN, CARL J.
OREGON STATE SYSTEM OF HIGHER EDUCATION, MONMOUTH
REPORT NUMBER BR-6-2871 PUB DATE SEP 67
NORTHWEST REGIONAL EDUCATIONAL LAB., PORTLAND, ORE
CONTRACT OEC-4-7-062871-3059
EDRS PRICE MF-$1.00 HC-$9.76 242P.

DESCRIPTORS- *ANNOTATED BIBLIOGRAPHIES, *INSTRUCTION, *SIMULATION, *INSTRUCTIONAL DESIGN, *COMPUTER ASSISTED INSTRUCTION, COMPUTERS, DECISION MAKING, GAMES, GAME THEORY, ECONOMICS, HUMAN RESOURCES, MODELS, INTELLIGENCE, OPERATIONS RESEARCH, PROGRAMED INSTRUCTION, TRAINING, SIMULATORS, MONMOUTH, PORTLAND,

THIS ANNOTATED BIBLIOGRAPHY ON THE INSTRUCTIONAL USES OF SIMULATION IS INDEXED FOR THE CONVENIENCE OF THE USER. ONLY LIMITED ASPECTS OF MAN-MACHINE INSTRUCTIONAL SYSTEMS ARE CONSIDERED. ALTHOUGH MOST OF THE ITEMS ARE RELATED TO THE INSTRUCTIONAL USES OF SIMULATION, SOME ITEMS ARE RELATED TO THE DESIGN OF INSTRUCTIONAL SYSTEMS. THE BIBLIOGRAPHY LISTS THE VERY LATEST REFERENCES AVAILABLE AND PURPOSELY OMITS MANY OF THE OLDER ARTICLES. (HW)

FILMED FROM BEST
AVAILABLE COPY

BR 6-2871-24
PA-24

ED019755

Instructional Uses of Simulation: a selected bibliography

Prepared by: TEACHING RESEARCH
A Division of the
Oregon State System of Higher Education
Monmouth, Oregon

In cooperation with: NORTHWEST REGIONAL EDUCATIONAL
LABORATORY
710 S. W. 2nd Avenue
Portland, Oregon

September 1967

EA 001 350

The Northwest Regional Educational Laboratory Program #320, "The Meaning and Measurement of Effective Teaching," sponsored a series of four Man-Machine Conferences during 1966-67. Eight national experts representing business, the military, behavioral science, and education, participated in exploring their divergent views regarding teaching effectiveness. A documentary film summarizing these viewpoints has been produced and is available for viewing. This selected bibliography is also the result of these efforts.

Film viewing requests should be addressed to the Northwest Regional Educational Laboratory.

INSTRUCTIONAL USES OF SIMULATION: A SELECTED BIBLIOGRAPHY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

Prepared By

TEACHING RESEARCH

A Division of The Oregon State System of
Higher Education

Monmouth, Oregon

In
Cooperation With

NORTHWEST REGIONAL EDUCATIONAL
LABORATORY

Portland, Oregon

September, 1967

Foreword

During late 1966 and early 1967, a series of four conferences were held in the Pacific Northwest on the contribution of man-machine systems to the meaning and measurement of effective teaching. The objectives of the four conferences were: (1) to identify activities, documented or not, pertaining to the use of instructional simulation devices and related man-machine systems for teaching purposes; and (2) to identify the contributions to effective teaching made by the use of simulation and related man-machine instructional systems. Eight consultants representing industry, the military, behavioral science, and education discussed viewpoints outside those of the traditional educational approaches. The products resulting from these conferences include: (1) a filmed report of the highlights of the four conferences; (2) a document which summarizes in written form the implications brought out in the filmed report, and (3) a bibliography listing the relevant publications and reports.

The topics covered in the bibliography reflect closely those considered by the eight consultants during the Man-Machine Conferences. Dr. Meredith Crawford, Director of the Human Resources Research Office, talked of the HumRRO model for the development of training programs. Dr. Howard McFann brought to the conference a vast experience of research on human performance within the military setting, and elaborated upon the HumRRO model. Dr. Harry Silberman of System Development Corporation discussed an instructional management system as an interim step preceeding the wide use of computer-assisted instruction. Dr. Clark Abt brought to the conference a broad background in simulation, especially teaching games. Mr. Hall Sprague of Western Behavioral Sciences Institute was also concerned with the building and evaluation of teaching games. Dr. Peter Winters, Associate Director of the Stanford University Computation Center, reviewed the educational implications of computer-supported business games. Dr. Earl Hunt, Professor of Psychology at the Universtiy of Washington, discussed computer simulations of thought processes. Dr. George Kneller, Professor of Education at U.C.L.A., talked about the ethical and practical limitations of the technological revolution in education.

This bibliography is best thought of in terms of a "selected bibliography," for two reasons. First, only limited aspects of man-machine instructional systems are considered. A glance through the bibliography will reveal that most of the items are related to the instructional uses of simulation. A fewer number of items are related to the design of instructional systems. Since the conferences did not deal directly with other man-machine systems such as language laboratories and computer assisted instruction per se, no effort was made to include references related to these topics. Second, the bibliography attempts to list the very latest references available, and purposely omits many of the older articles, particularly those that are listed by quite a few references, unless they appear to be "classics" in their field. It should be noted that rather extensive bibliographies are available in certain subject areas, and that no attempt was made to replicate these efforts or reproduce these works (see references listed under the heading "Bibliography" in the Index).

Instructions for the Use of the Bibliography

Before attempting to locate references on a specific topic, the reader should examine the index and become familiar with the descriptors. The index does not list every descriptor that is relevant to each referenced document, but is limited mainly to key words or subject areas. Once the reader has noted the descriptors of interest, and the number that is assigned to each referenced document, he can then turn to the references. Wherever possible, annotations are included.

Generally, the documents referenced in this bibliography are not available from Teaching Research or the Northwest Regional Educational Laboratory. However, many of the references are easily found in professional journals located in most of the larger libraries. Reports of federally sponsored projects may be obtained from the Clearinghouse for Federal Scientific and Technical Information.

Acknowledgements

The preparation of a bibliography of this magnitude requires considerable dedication and time. The project staff is especially appreciative of the efforts of Mrs. Lois Owen, who almost single-handedly collected and annotated the references. The staff is also indebted to Mr. William Hickok who assisted Mrs. Owen in the later stages of the project and supervised the production of the bibliography, and Mr. Gerald Girod, who conducted the indexing of the references.

Paul A. Twelker
Associate Research Professor
Teaching Research

Carl J. Wallen[1]
Associate Research Professor
Teaching Research

---

[1] Now at the University of Oregon

ARTIFICIAL INTELLIGENCE

34 37 72 97 230 242 252 267 296 299

300 306 319 320 378 379 380 386 490 534

535 536 547 548 553 554 555 556 557 573

577 607 638 639 641 653 659 686 687 751

802

BEHAVIORAL CHANGE

414

BEHAVIORAL OBJECTIVES

26 28 840

BIBLIOGRAPHY

Artificial Intelligence

535 577 659 686 687

Audio-visual

217

Computer Simulation

204 230 342 609

Cost Analysis

192 194

Cost Effectiveness

193 784 795

Games

157 188 258 355 616 659 833

BIBLIOGRAPHY (CONT'D)

Human Factors

384 575 724

Management Analysis

505

Man-machine System

609 724 784 795

Media

235

Operations Research

192 541 795

Programmed Instruction

195

Simulation

188 230 310 342 384 505 541 624 659 737 797 833

Simulation, Artificial Intelligence

319 320

Simulation, Monte Carlo Method

659

Simulation, Social Science

309

Simulation, Techniques

737

BIBLIOGRAPHY (CONT'D)

Simulation Theory

833

Sociodrama

271

Technology

235

Training Device

446

Training Objectives

698

Training, Quality Control

699

Training, Research

288

CLASSROOM SIMULATION

89 432 433 434 435 529 753 754 771 772

COMPUTER

Game, Economic

150 151 170 437 450 516 609 668 669 804
805

Game, Military

609

COMPUTER (CONT'D)

General

83 204 235 267 270 287 402 638 652 670
682 751 816 845

Instructional Management System

550 685

Model

145 177 298 299 313 314

Simulation

1 4 13 17 37 44 60 64 65 68
69 91 96 98 103 134 135 136 138 143
154 159 160 162 163 164 173 177 214 226
230 231 243 247 253 264 277 286 291 295
299 309 312 318 320 328 342 343 345 357
365 368 378 379 380 386 393 403 412 425
426 442 449 462 473 475 476 514 515 517
537 538 539 551 553 554 555 568 569 571
579 580 581 584 628 630 631 632 641 669
690 693 709 730 731 732 735 746 748 756
757 758 768 781 788 824 839

Simulation, Analog

45 108 190 211 248 272 331 390 502 605
619 726 738 739 798

COMPUTER (CONT'D)

Simulation, Digital

16 40 58 97 106 108 109 113 117 141
145 181 182 211 222 232 251 272 290 296
303 305 313 314 331 333 387 390 391 409
454 455 456 461 493 502 508 557 564 602
606 507 609 619 625 626 651 667 671 672
673 674 676 677 678 679 680 707 726 738
769 774 792 798

Simulation, Languages

469 509 511 747 789

Study of Man-machine System

418 430 465 670 679 729 738 739 811

CROSS-CULTURAL TRAINING

297 715 716 717

DECISION MAKING

9 33 43 88 90 91 96 106 115 125
126 133 139 179 187 225 237 302 347 348
349 352 362 394 395 501 503 537 550 570
573 599 601 610 658 660 688 718 741 766
788 807 814

EDUCATIONAL THEORY

120 196

GAMES

Computer

150 151 157 170 333 402 437 450 516 609
668 669 804 805

Economic

10 11 30 50 57 85 86 106 130 142
146 147 148 150 151 171 178 187 191 199
200 201 202 203 249 256 258 265 301 302
304 334 352 362 377 394 405 430 436 437
438 450 495 496 590 601 610 617 710 741
742 743 744 750 766 793 794 844

General

2 3 5 6 7 9 19 21 39 48
56 62 76 77 80 81 86 92 93 94
95 99 110 125 126 127 128 130 139 148
149 152 153 155 156 157 178 185 186 207
209 237 239 244 257 265 273 274 285 286
292 301 334 335 347 348 349 361 375 376
398 399 400 406 420 448 451 471 491 520
558 565 585 589 590 591 594 596 614 616
620 637 644 648 658 694 700 708 735 736
770 775 776 777 778 779 815 818 822 828

Military

8 42 43 48 256 257 285 333 420 430

GAMES (CONT'D)

Military (Cont'd)

596 616 735 786 786 822

Social Studies

3 5 77 155 273 356 402 448 620 621
647 704

GAME THEORY

12 38 47 62 64 67 71 75 78 99
120 183 207 238 241 289 331 334 336 337
338 339 340 359 398 399 427 440 445 452
453 463 466 467 468 477 478 479 480 500
533 558 565 592 593 594 595 596 597 599
600 602 633 640 644 645 648 649 654 655
656 658 660 661 666 669 691 722 735 736
740 785 796 797 799 801 808 821

HUMAN FACTORS

23 24 28 61 74 112 114 118 250 291
346 384 388 419 439 489 512 518 522 523
530 546 549 575 576 587 627 670 679 701
707 724 725 749 795 829

IN-BASKET TECHNIQUE

65 106 184 395 565

INFORMATION PROCESSING

121 148 225 226 228 421 561 689 690 791

INSTRUCTIONAL OBJECTIVES

(SEE BEHAVIORAL OBJECTIVES)

INSTRUCTIONAL TECHNOLOGY

470 189 196 234

MAN-MACHINE SYSTEM

29 59 63 74 250 305 358 413 439 473
474 566 642 721 724 725 749 751

Computer

221 418 430 465 609 626 729 738 739 792

Simulation

221 275 277 278 279 281 282 489 571 582
609 626 665 670 673 674 675 676 677 678
679 680 692 729 738

Task Analysis

486 530 546

MODELS

4 8 27 50 79 121 122 134 144 145
180 215 223 224 232 234 241 244 251 253
264 270 280 282 290 305 315 324 332 335
343 345 363 364 381 393 423 436 444 449
450 459 475 500 501 508 537 550 569 628
633 636 640 641 683 688 733 756 757 758
767 773 827 839 846

MODEL (CONT'D)

Cognitive

298 313 314 318

Information Processing

65 229 387 416 791

Learning

653 722 773

MOTION PICTURE

Instruction

263

Testing

52 55 284 643

OPERATIONS RESEARCH

192 193 194 236 267 329 330 389 454 504
541 542 543 617 669 736

Cost Effectiveness

193

Simulation

266 330 541 542 543 834

PROGRAMMED INSTRUCTION

19 102 189 195 446 487 524 526 550 574
652 684 695 720

SIMULATION

20 59 65 70 96 105 176 180 181 182
184 190 198 211 212 214 215 218 219 221
222 223 224 226 227 229 231 232 233 236
242 243 245 247 248 251 253 254 255 259
261 262 264 266 269 270 272 275 276 277
278 279 281 282 283 286 290 294 295 296
299 303 305 307 309 311 312 316 317 318
319 320 321 322 325 326 327 328 329 330
331 341 343 345 350 351 353 354 356 357
364 365 370 371 378 379 380 381 386 387
389 390 391 392 393 396 397 407 408 409
411 412 415 416 417 423 425 526 431 436
439 441 442 449 454 455 456 457 458 461
462 464 473 475 476 484 485 490 492 493
499 502 504 506 507 508 509 510 511 515
517 519 520 521 528 532 537 543 547 548
551 553 554 555 556 557 562 563 564 567
569 571 579 580 581 582 585 596 599 602
603 604 605 606 607 609 611 612 613 615
619 621 623 625 626 628 630 631 632 634
636 641 647 650 651 657 662 663 667 669
670 671 672 673 674 675 676 677 678 679

SIMULATION (CONT'D)

680 686 687 689 690 692 693 705 706 707
708 709 711 713 714 715 716 717 726 730
731 732 733 735 738 746 747 748 756 757
758 761 817 824 826 838 848

Artificial Intelligence (see ARTIFICIAL INTELLIGENCE)

Cognitive Processes (see ARTIFICIAL INTELLIGENCE)

Collective Bargaining

206

Computer (see COMPUTER, Simulation)

Dental Emergency

482 483

Disaster Control

422 727

Drawbacks

428

Driver Research

323 344

Driver Training

344 383 498

Economic Model

51 300 363 366 367 368 369 568 584

Electronic Maintenance Tasks

216

SIMULATION (CONT'D)

Evaluation Purposes

52 55 284 643 712

Fidelity

14 35 37 53 54 61 100 168 205 308
332 388 434 435 544

Fire Control Training

117 220 372 760

Flight Trainer

14 59 107 112 113 114 116 240 410 429
544 545 702

Group Atmosphere

73

History of

82 109 681

Man-machine System (see MAN-MACHINE SYSTEM, Simulation)

of Business Firm

35 143 360 514 538 539 542 622 664 665
742 783 823

of Decision-Making Processes

96 133 179 225 230 347 348 501 503 573
788 814

of Multinuclear Future

101

SIMULATION (CONT'D)

Realism (see SIMULATION, Fidelity)

Teacher Education

89 175 432 433 434 435 529 753 754 764
765 771 772 782 832 842

Teacher Selection

87 88

Theory

311 332 541

Weapons System

268 701

SIMULATION TRAINING

Decision-Making

9 33 43 87 88 90 91 106 115 125
126 139 187 301 302 324 362 395 718 763
807 827

SIMULATIONS

Design of

25 58 66 123 124 127 161 172 173 236
240 294 295 308 329 330 331 365 382 389
412 439 489 530 531 532 540 541 542 543
544 563 604 611 620 630 701 717 737 817
819 825 834

SOCIODRAMA

271

SYSTEMS ANALYSIS

135 137 193 194 376 403 473 618 635 642

683 696 752 767

SYSTEMS DESIGN

16 37 83 174 374 549 679 702 721 733

745

SYSTEMS EFFECTIVENESS

210

TASK ANALYSIS

26 27 419 486 527 530 532 546 719 734

810

TRAINING

100 197 213 220 244 245 259 260 297 311

321 326 327 344 353 373 382 424 432 433

438 443 472 482 497 499 502 515 527 529

530 560 578 583 585 587 612 623 629 646

683 695 698 702 703 713 745 752 762

Management Game (See GAMES, Economic)

Management

25 142 169 304 601 743 744 794

Military

26 27 167 174 260 261 268 273 288 447

487 502 519 572 588 697 714 759

Transfer

TRAINING (CONT'D)

Transfer

14 100 326 531 544 545

TRAINING DEVICES (EQUIPMENT)

112 114 116 167 168 262 293 325 446 447

481 519 531 544 559 572 586 588 696 728

1 Abelson, R.P. and J.D. Carroll. COMPUTER SIMULATION OF INDIVIDUAL BELIEF SYSTEMS. *American Behavioral Scientist*, 9, 24-30, May 1965.

> The authors attempt to simulate "affect-laden cognitions concerning aspects of the psychological world of a single individual." The intention of the simulation is to represent the structure of the interrelationships, and also some of the processes by which the system maintains itself against the intrusion of new and potentially upsetting information. "The operation of simulated belief systems can be played out on the computer and the details scrutinized in order to refine our level of approximation to real systems."

2 Abt Associates, Inc. EXAMPLES OF EDUCATIONAL GAMES. Cambridge, Mass.: Abt Associates, Inc., June 30, 1966.

> 19 games are listed, giving the following information about them: names of organizations using the games; educational level; subject of game; number of players per game; and time required to play the game, in hours.

3 Abt Associates, Inc. THE ENGLISH CIVIL WAR UNIT. Cambridge, Mass.: Abt Associates, Inc., Xeroxed paper, 1966.

> A description of a game developed and designed for Educational Services, Inc., Junior High School Social Studies Curriculum.

4 Abt, Clark C. DESIGN FOR AN EDUCATION SYSTEM COST-EFFECTIVENESS MODEL. Cambridge, Mass.: Abt. Associates, Inc., (1966).

> This paper presents a design for an elementary and secondary education cost-effectiveness model, emphasizing evaluation of the U.S. Elementary and Secondary Education Act's Title I programs for the disadvantaged. The design attempts a quantitative description of education systems that may be programmed as a computer simulation.

5 Abt, Clark C. GAMES FOR LEARNING. Cambridge, Mass.: Educational Services, Inc., Occasional Paper Number 7, 1966.

Among the many new devices which are being developed for the purpose of motivating children to learn and of increasing their ability to learn, one of the most interesting is that of teaching games. Young children do a great deal of learning by playing games. . . We have not frequently thought of games as teaching devices for secondary school classrooms. In this paper, the theory behind using teaching games is explored and some particular games designed for the Social Studies Curriculum Program of Educational Services, Inc., are discussed.

6 Abt, Clark C. THE REDISCOVERY OF EXPLORATORY PLAY, PROBLEM-SOLVING AND HEURISTIC GAMING AS A MORE SERIOUS FORM OF EDUCATION. Paper read at the Conference on Innovation in Education, Lake Arrowhead, December 1965.

7 Abt, Clark C. HEURISTIC GAMES FOR SECONDARY SCHOOLS. Cambridge, Mass.: Abt Associates, Inc., Mimeographed report, 1965.

8 Abt, Clark C. WAR GAMING. International Science and Technology. 32, 29-37, 1964.

The author gives a descriptive introduction to war gaming, model building, and simulation. A strategic model simulation (TEMPER), which was developed under the direction of the author, is described. TEMPER attempts to simulate cold war and limited war by including military and "other-than-military" factors. A good perspective of the value of war gaming is maintained throughout the paper. This paper is nonmathematical and is appropriate for the interested layman. Its contribution lies in its description of another simulation and its discussion of factors involved in war gaming at an international level of conflict.

9 Abt, Clark C. AN EDUCATION SYSTEM PLANNING GAME. Xeroxed paper, (no date).

This is a description of a game played by the participants in the Conference on Educational Innovations held at Lake Arrowhead, California on December 19, 1965. Its objectives were to illuminate some of the major issues of education planning, to excite an increased awareness in the participants of some of the alternative plans and their costs and benefits, and to stimulate a problem-focused exchange of ideas among players of diverse approaches to education.

10 Abt, Clark C. and Richard C. Scott, Jr. SIMULATIONS AND TRAINING PROGRAMS. Banking. 59, 49, 1966.

Training games as supplemental to bank training programs explained. Trainees can develop skills in a make-believe situation which is a meaningful representation of a real bank problem.

11 Acer, J.W. BUSINESS GAMES: A STIMULATION TECHNIQUE. State University of Iowa, Iowa City, Iowa, 1960.

12 Ackoff, Russell L. GAMES, DECISIONS, AND ORGANIZATIONS. In: General Systems: Yearbook of the Society for General Systems Research, 4, 145-150. Published by the Society, 1959.

The author addresses himself to what he calls a "fundamental misconception in game theory which has had, a deleterious effect on both theoretical and experimental work on individual and collective decision making. This misconception derives from the failure to distinguish what might be called an 'exercise' and a 'problem'. . . It is manifested by the assumption that games are adequate models of at least some problem situations. It leads to a multiplicity of decision criteria under so-called 'uncertainty' conditions and to an inability to determine which criterion is 'best'. This, in turn, has led many scientists to play games while suffering under the illusion that they are conducting theorectical or experimental inquiries". The essay directs itself to the clarification and justifications of these assertions.

13 Adams, E.A. and R.D. Forrester. CARMONETTE: A COMPUTER COMBAT SIMULATION. Operations Research Office, Johns Hopkins University, Washington, D.C., 1959.

14 Adams, Jack A. SOME CONSIDERATIONS IN THE DESIGN AND USE OF FLIGHT SIMULATORS. Lackland Air Force Base, Texas: Air Force Personnel and Training Research Center, April, 1957. (Research Report AFPTRC-TN-57-51, ASTIA Document No. 126382).

A philosophy for flight-simulator design and utilization, particularly in reference to current and future manned air weapons. The experimental literature on transfer of training is surveyed, and related to fidelity-of-simulation problems.

15 Aetna Life Insurance Company. THE DRIVOCATOR. School Management. 11(2), 156-157, 1967.

The classroom phase of driver education with the new Aetna Drivocator System, explained. (This is an advertisement.)

16 Alexander, Lawrence T. MAN-MADE SIMULATION AS A SYSTEM DESIGN AND TRAINING INSTRUMENT. Report No. SP-3331/000/01, System Development Corporation. September, 1961. (Paper presented at the Seventh Annual Meeting of ORSA, 1960, New York).

Bioscopic simulation is a research technique which is particularly useful for obtaining human performance data in a complex system environment. This technique can also be used to evaluate prototype configurations of man-machine systems in design stages as well as for training personnel in operating systems. It is shown how bioscopic simulation has been incorporated in the training of a large, information-processing system and how it may be used in system design.

17 Alexander, Lawrence T. et al. A GENERAL PURPOSE SIMULATION FACILITY ON HUMAN FACTORS PROBLEMS, SD-3167, System Development Corporation, 1959.

18 Allderige, J.M. COMPATIBLE SYSTEMS SIMULATION. Paper read at the American National Meeting of TIMS, June 1959.

19 Allen, Layman E. GAMES AND PROGRAMED INSTRUCTION. Programed Instruction. 5(6), 9-11, March 1966.

Combining games and programed materials can teach in a "fun" way appropriately done, the combination can stimulate and maintain motivation for learning in a way that will be quite useful. This paper describes two games, "Wff 'N Proof" and "Equations" which are examples of usefully combining progamed instruction and games.

20 Allen, M. A CONCEPT ATTAINMENT PROGRAM THAT SIMULATES A SIMULATANEOUS-SCANNING STRATEGY. Behavioral Scientist. 7(2), 247-250, 1962.

> The programs described in this paper are simulations of the simultaneous scanning strategy demonstrated in an experimental situation.

21 Allen, Robert. A STUDY CONDUCTED AT THE BURBANK UNIFIED SCHOOL DISTRICT. Burbank, California, 1964.

> The study determined the effects on students of specific games used in the classroom. Allen is now at Nova Academic Games Project, Fort Lauderdale, Florida.

22 Alperin, R.J. A SIMULATION IN THE BEGINNING COURSE IN AMERICAN GOVERNMENT AND POLITICS. University of Maryland, Mimeographed paper, 1962.

23 Altman, J.W. IMPROVEMENTS NEEDED IN A CENTRAL STORE OF HUMAN PERFORMANCE DATA. Human Factors. 6(6), 681-686, December 1964.

> "A central data store represents an attempt to make quantitative information about human performance conveniently available for system planning, functions allocation, equipment design, selection and training, and evaluation. Major areas for future improvement of data store technology include establishment of a central function to integrate human performance data, quantification of meaningful categories of psychological processes, development of an error taxonomy, improved scaling of laboratory to operational performance, inclusion of new types of behavior, relating of conditions under which performance is accomplished to performance levels, and development of a basis for forecasting behavioral loading from early system information."

24 Altman, J.W. SOME INITIAL APPROACHES TO QUANTIFIED HUMAN FACTORS EVALUATIONS. Presented to: Human Factors Society, National Meeting, November 28, 1962.

Establishes the need for "quantification of human factors evaluations" on two bases.

1. In design - to balance human factors against other aspects.
2. For estimating their overall impact on the system.

The approaches that he discusses are:

1. Maintainability index
2. Operability index, including:
    a. Objectives
    b. Behavior analysis
    c. Human performance data
    d. Method of evaluation
    e. Try out

25 American Management Association. SIMULATION AND GAMING: A SYMPOSIUM. AMA Management Report No. 55, 1961.

In this report, informed observers of and participants in the field of simulation discuss each of three areas of application: (1) an operations research tool, (2) as a behavioral-research tool, and (3) as a teaching tool. Special emphasis in this report is upon the use of gaming as a management tool.

26 Ammerman, H.L. DEVELOPMENT OF PROCEDURES FOR DERIVING TRAINING OBJECTIVES FOR JUNIOR OFFICER JOBS. Technical Report 66-3, The George Washington University, Human Resources Research Office, Alexandria, Virginia, May 1966.

Research was undertaken to develop a systematic method that could be used by service school personnel to prepare job-oriented training objectives for junior officers, primarily in the form of behavioral statements of student performance expected after training. The procedures developed are divided into four phases: A--Listing of all tasks for a job; B--Selecting tasks for some formal training; C--Identifying the training emphasis needed in the selected tasks; D--Specifying the knowledges and skills necessary for the selected training aspects. The procedures included administration of experimental questionnaires, both by personal interview and by mail, reviews of pertinent directives and publications, and visits to field units. As the procedures were developed, they were tried out on a sample officer job (Nike Hercules Fire Control Platoon Leader). In the trial application, a task inventory of 452 items provided the basis for choosing, by use of definite selection rules, 101 job activities (22%) for some formal schooling; of 160 training objectives stated for these activities, 46 were performance-type objectives for which detailed activity descriptions were required. It is believed that use of these procedures by service school personnel to prepare junior officer training objectives is feasible, and that these procedures provide a method for deriving behavioral statements of relevant and essential objectives.

27 Ammerman, H.L. A MODEL OF JUNIOR OFFICER JOBS FOR USE IN DEVELOPING TASK INVENTORIES. Technical Report 65-10, The George Washington University, Human Resources Research Office, Alexandria, Virginia, November 1965. 54pp.

A job description procedure was developed for use by Army service schools in identifying all of the tasks performed by junior officers in a job assignment. This procedure was based on a model of officer job behavior, illustrating the nature and sequence of tasks performed to attain specific goals within each area of responsibility. The behavior model was itself developed from considerations of existing job descriptions, the nature of job information typically provided by interviews with officers, and an information-processing view of purposive behavior. Application of the description technique to one officer job yielded 816 tasks covering troop leadership and unit management, as well as tactical and technical functions. General statements of work were effectively broken into task-level statements of job activities. The technique should provide a practical means for describing most supervisory and command jobs characterized by a high proportion of variable, nonroutine, and covert activities. (Author)

28 Ammerman, H.L. and W.H. Melching. THE DERIVATION, ANALYSIS, AND CLASSIFICATION OF INSTRUCTIONAL OBJECTIVES. Technical Report 66-4, The George Washington University, Human Resources Research Office, Alexandria, Virginia, May 1966. 55pp.

An examination of the methods, terms, and criteria associated with the determination of student performance objectives was made in order to synthesize and apply the relatively new developments in Human Factors research on this subject. Educational and training research literature on the subject was examined to identify procedures currently being used or proposed. A survey of eight Army service schools was conducted to determine procedures employed by instructional personnel in determining course content. On the basis of data obtained, important problems arising in connection with the development of objectives are identified and analyzed. A system for analyzing instructional objectives by identifying factors that influence their meaningfulness and usefulness was developed. Types of student performance objectives are listed, and a classification scheme for terminal objectives is suggested. The classification is based on five factors on which a statement of an objective may vary, affecting the nature of the student action description and the communicability of the statement itself. The variety of terms associated with objectives are discussed.

29 Amorelli, D., J.T. Celentano and B.G. Peters. RELIABILITY AND THE MAN SUBSYSTEM. North American Aviation, Inc., Space and Information Systems Division, PUB 544-5, NEW 9-63. DDC #459187, 19 August 1963.

This paper discusses the concept of reliability and the relationship of man to total system reliability. Techniques of determining reliability are considered.

30 Amos, J.M. EDUCATIONAL ASPECTS OF BUSINESS GAMES. Journal of Business Education. 40, 61-62, November 1964.

31 Anderson, Alan Ross (ed) MINDS AND MACHINES. Prentice-Hall, 1964.

32 Anderson, L.F. COMBINING SIMULATION AND CASE STUDIES IN THE TEACHING OF AMERICAN FOREIGN POLICY. Evanston, Illinois: Northwestern University, Mimeographed report, 1964.

33 Anderson, L.F. et al. A COMPARISON OF SIMULATION, CASE STUDIES, AND PROBLEM PAPERS IN TEACHING DECISION-MAKING. Evanston, Illinois: Northwestern University, Mimeographed report, 1964.

34 Andrew, Alex M. LEARNING IN A NONDIGITAL ENVIRONMENT. In: Aspects of the theory of artificial intelligence. The Proceedings of the First International Symposium on Biosimulation, 1960. 1-7 New York, Plenum Press, 1962.

35 Antrim, William H. REALISTIC LEARNING IN A SIMULATED ENVIRONMENT. American Vocational Journal, 42, 29-31, 1967.

A description of a simulation of a department store operation used in high school, designed to give distributive education teachers suggestions for combining classroom learning with on-the-job training. Merchandising techniques, as well as involvement in human relations training, are learned by students.

36 Arthur, W. TO SIMULATE OR NOT TO SIMULATE: THAT IS THE QUESTION. Educational Data Processing Newsletter, 2, (4), 9. (no date).

37 Ashby, W.R. WHAT IS AN INTELLIGENT MACHINE? Proceedings of the Western Joint Computer Conference, 19, 275-280, 1961.

The limitations and "reality" of assessing the simulation of "intelligence" are described and discussed. Some of the problems facing the computing engineer in designing systems to simulate "intelligence" are discussed: "intelligence" shows itself by appropriate selection, and by achieving its goal in the shortest time.

38 Atkinson, R.C., and P. Suppes. AN ANALYSIS OF TWO-PERSON GAME SITUATIONS IN TERMS OF STATISTICAL LEARNING THEORY. Journal of Experimental Psychology, 55 (4), 1958.

39 Back, K.W. THE GAME AND THE MYTH AS TWO LANGUAGES OF SOCIAL SCIENCE. Behavioral Science 8 (1), 66-71, 1963.

This paper argues that the breakdown in communication between the humanist (who uses the myth, and the language of the myth) and the scientist (who uses the game, or model, and the language of gaming) is due to the use of the same language but attributing different meanings to the same words. The social scientist, says the author, must learn to speak both languages.

40 Baker, Frank B., and Thomas J. Martin. AN IPL-V TECHNIQUE FOR SIMULATION PROGRAMS. Educational and Psychological Measurement 25 (3), 859-865, 1965.

A pseudo-code system with executable or non-executable routines and an associated recursive interpreter are proposed to avoid having to write unique instructions to handle the between routine communication of information. Although the scheme was developed for a particular simulation project, the approach is thought to have general applicability in other areas of simulation.

41 Baker, Gene. A COMPARATIVE STUDY USING TEXTBOOK AND SIMULATION APPROACHES IN TEACHING JUNIOR HIGH AMERICAN HISTORY. Doctoral Dissertation in progress, School of Education, Northwestern University. (Reported October 1966)

42 Baker, R.A. THE ARMOR COMBAT DECISIONS GAME. Armor LXXI (1), January-February 1962.

43 Baker, R.A. et al. THE EFFECTS OF SUPERVISORY THREAT ON DECISION MAKING AND RISK TAKING IN A SIMULATED COMBAT GAME. Behavioral Scientist, 11 (3), 167-176, May 1966.

The effect of threat (in the form of a severely displeased military superior) is examined using a task involving vigilance, data processing, and decision making in simulated (automated) combat. 80 Army career officers served as Ss. Two theoretically significant points emerged: (1) As both common observation and experimentation have shown, some individuals appear to be stimulated by stress and produce a more effective performance while others show behavioral disorganization and a reduction in the effectiveness of their performance. (2) It is believed that psychological stress depends on the anticipation of something harmful in the future and requires an interpretation by S about the personal significance of the stimulus situation. Threat can thus be regarded as the central intervening variable in psychological stress.

44 Balderston, F.E. and A.C. Hoggatt. SIMULATION OF MARKET PROCESSES. Berkeley, California: Institute of Business and Economic Research, 1962.

This book is a report on a simulation of the lumber market as a FORTRAN program. The complex relationships are evolved into formulas.

A simulation must be reduced to simple useful rational results. A major presumption of this simulation is that market behavior can be reduced to relationships. It is accepted that a perfect market does not exist. The question is the extent of the departure from such market. In the lumber business this is very extensive. Certain factors which are important market considerations could have been given greater weight.

45 Baldwin, R.D. INSTABILITY IN ANALOGUE-TYPE TARGET SIMULATORS. Paper read at NTDC Conference on Radar Simulation, Port Washington, New York, May 1961.

46 Baldwin, R.D. and A.D. Wright. AN ATTEMPT TO DEVELOP A RADAR OPERATOR SCREENING TEST: A REPORT OF SIMULATOR INSTABILITY. Technical report 79, June 1962.

As a possible means of improving the effectiveness of radar operators, a short screening test - a by-product of previous research - was given to air defense missile crewman trainees in an attempt to identify individuals likely to be particularly adept at target detection. Subjects were given a proficiency test to validate the training implications of the earlier findings. The high correlations originally found between scores on the screening test and the proficiency test were discovered to have been a consequence not of consistent differences in human abilities, but of instability in simulator output signals. It was concluded that it is not feasible to develop any type of screening test using radar simulation equipment having tolerances in "burn through" range greater than 1% maximum radar range.

47 Balzer, Robert M. A MATHEMATICAL MODEL FOR PERFORMING A COMPLEX TASK IN A CARD GAME. Behavioral Science 11 (3), 219-226, 1966.

Programs simulating card playing are written less frequently than those for board games such as chess, checkers, or tic-tac-toe because the initial stages of card games are not identical -- the dealing of cards produces one of many conditions. This problem is discussed in regard to the game of Hearts.

48 Barringer, Richard E., and Barton Whaley. THE MIT POLITICAL MILITARY GAMING EXPERIENCE. Orbits, 9 (Summer), 437-458, 1965.

49 Bartlett, F.C. PRINCIPLES OF SYNTHETIC EQUIPMENT AND TRAINING. (Medical Research Council). Cambridge, England: Applied Psychology Research Unit, The Psychological Laboratory, December 1950.

"The most important aim of synthetic training is to teach the learner in such a way that he will readily, and, as nearly as possible, automatically transfer what he learns to as wide a range of related situations and equipment as may be required."

A concise statement of principles and requirements of synthetic training equipment.

50 Bastable, C.W. BUSINESS GAMES, MODELS, AND ACCOUNTING. Journal of Accountancy, 109, 56-60, March 1960.

51 Bauer, Raymond A. and Robert D. Buzzell. MATING BEHAVIORAL SCIENCE AND SIMULATION. Harvard Business Review 42 (5), 116-124, 1964.

Behavioral science concepts and findings are used as a basis for mathematical analysis of a hypothetical marketing problem.

52 Beaird, J.H. FILM TESTS AS PREDICTORS OF TEACHING BEHAVIOR. Paper presented at AERA Symposium, The Prediction of Teaching Behaviors, New York, 1967.

The paper presented a study attempting "to accurately predict how effectively teachers will behave in classrooms." The results "clearly supported the hypothesis that as test stimuli become more representative of the behavior to be predicted, and as the opportunity for response approaches the freedom characteristic of life situations, the power of prediction increases." The extent to which prediction was possible with the more life-like tests also was consistently higher than the bulk of the previous studies.

53 Beaird, James H. AUDIO SIMULATION IN COUNSELOR TRAINING. Paper read at the AERA Convention, Chicago, February 1966.

Description of a project in which simulation techniques were applied to the field of counselor training, and techniques to develop realism in simulated interpersonal environments permitting continuous interaction between learner and simulation package are also described.

54 Beaird, James H. and John T. Standish. AUDIO SIMULATION IN COUNSELOR TRAINING. Final report, Title VII, Project No. 1245, NDEA of 1958, Grant No. 7-47-0000-235, December 1964.

This report describes instruction designed to develop specific skills in a meaningful setting, i.e., a setting which provides many of the cues, demands, and characteristics which will be present in actual situations for which those specific skills are required.

55 Beal, Karen. A COMPARISON OF ORAL AND WRITTEN RESPONSES TO A CLASSROOM SIMULATION TEST. Unpublished Masters Thesis, Oregon State University, 1964.

56 Beale, E.M.L. PRELIMINARY NOTE ON THE ROLE OF GAMING IN OPERATIONAL RESEARCH. (Processed working paper) Admiralty, Operational Research Department, Memorandum No. 181, June 1959.

57 Bellman, R. *et al*. ON THE CONSTRUCTION OF A MULTI-STAGE, MULTI-PERSON BUSINESS GAME. *Operations Research*, 5 (August), 469-503, 1957.

58 Bellman, Richard, Merril B. Friend, and Leonard Kurland. SIMULATION OF THE INITIAL PSYCHIATRIC INTERVIEW. *Behavioral Science*, 11 (5), 389-399, 1966.

> Systematic exploration of interviewing techniques is made possible by the procedures described. A nontechnical lexicon of fundamental concepts in the theory of dynamic programming is presented and their relevance to psychiatric interviewing is discussed. The simulation process constructed, using a digital computer, excerpts from it, and the ideas guiding the construction are discussed.

59 Belsley, S.E. MAN-MACHINE SYSTEM SIMULATION FOR FLIGHT VEHICLES. IEEE Transactions on Human Factors in Electronics. HFE-4(1), 4-14, September 1963.

> A procedure for conducting a meaningful simulation of a man-machine system is presented and illustrated by various specific examples. The relationship of the various types of simulators to their use is outlined and desirable detailed characteristics are delineated. The trade-offs between simulator complexity, realism, and the interrelation of various sensing cues (motion, visual, or tactile) are discussed and the necessity of validating the simulation by use of a variable stability and variable control system aircraft is noted. It is shown that as the problem to be studied becomes more complicated or the questions asked of the simulator become more quantitative, the simulator characteristics must become more flight-like, since, in the last analysis, the best place to ask the question is when the pilot and the vehicle are immersed in the true environment (i.e., flight).

60 Bennington, H.D. DUAL-MACHINE SIMULATION. SP-23, System Development Corporation, Santa Monica, 1958.

61 Berkun, M.M. PSYCHOLOGICAL AND PHYSIOLOGICAL CRITERIA FOR STRESS SIMULATION RESEARCH. Paper read at 3rd Annual Symposium, Human Factors Society of Los Angeles, June 1963.

To predict, from experimentation, the ability of men to cope with real stresses requires first a validation of the experimental situation as a substitute criterion for uncontrollable reality. Simulation of a stressful environment must avoid cues which invite the subject to deliberately assume a role or which provide him with more psychological support than he will receive in the reality to which the findings must generalize. The task he is to perform must be meaningful in the stress-producing context. Stressors which fulfill these requirements ought to produce (a) a measurable disturbance of performance, (b) a report of awareness of a feeling of discomfort, fear, threat, or unpleasantness, and (c) a measurable perturbation of physiological processes.

62 Berne, Eric. GAMES PEOPLE PLAY. New York: Grove Press, 1964.

Games are forms of social contact in which the behavior and emotions of the individuals involved are regulated by social sanction. Berne's theory of social intercourse, descriptions of games, and analysis of this descriptive material in terms of his theory, are given.

63 Berry, P.C. and J.J. Wulff. A PROCEDURE FOR PREDICTING RELIABILITY OF MAN-MACHINE SYSTEMS. IRE International Convention Record, Part 10, New York IRE, 112-120, March 1960.

"The reliability of the final output of a complex man-machine system is a function of the reliability of the component hardware, of operator performance, and of maintenance technician performance. This paper presents a technique for describing the reliability of any system component, whether it be a hardware or a personnel component, and a technique for generating a complete integrated man-machine description in terms of these component descriptions. These techniques provide the basic elements of a procedure for predicting the overall reliability of man-machine systems on the basis of design descriptions of such systems. These techniques also provide a basis for measuring overall man-machine system reliability, and for designing man-machine systems to achieve maximum overall reliability."

64 Bertalanffy, Ludwig von and A. Rapoport (Eds.). GENERAL SYSTEMS: YEARBOOK OF THE SOCIETY FOR GENERAL SYSTEMS RESEARCH. Ann Arbor, Mich.: Braun-Brumfeld, 1960. 4, 260pp.

Contains papers on game theory, computer simulation and construction of artificial organism, digital simulation or an evolutionary process.

65 Bessent, Wailand. A FEEDBACK PROCEDURE FOR SIMULATION OF ADMINISTRATIVE IN-BASKET PROBLEMS. Paper delivered at 1967 AERA Symposium on Feedback in Simulation Techniques, New York, 1967.

The development described in this paper is a man-machine simulation in which a trainee takes the role of an administrator in an information system and the computer simulates the information by providing feedback of information. To accomplish this, both a satisfactory model of information search and a computer program for the model were devised.

66 Biel, W.C. OPERATIONS RESEARCH BASED ON SIMULATIONS FOR TRAINING, SP-16, System Development Corporation, National Conference of Aeronautical Electronics, 1958.

67 Birney, Robert C. and Neil A. Stillings. THE EFFECT OF FEAR OF FAILURE ON CHOICE OF STRATEGY IN PRISONER'S DILEMMA. Technical Report No. TR-22. Bucknell University, March 1967. (Prepared in cooperation with Amherst College).

The two-person non-zero sum game called Prisoner's Dilemma was used to investigate the fear of failure (FF) motive (operationally defined in terms of the Hostile Press (HP) scoring system of the TAT and the need for achievement (nAch) in a situation where competition leads to failure and cooperation leads to success. Any one of three basic patterns of play (called Competitive, Defensive, and Optimal) were used by all Ss in the game situation as indicated by the way in which the Ss chose to describe their own behavior on a questionnaire after the experiment. It was hypothesized that high HP-high nAch Ss would show defensive play patterns significantly more often than Ss in other motive groups, low HP-high nAch Ss would show competitive play patterns more often, and high HP-low nAch and low HP-low nAch Ss would show optimal play patterns more often than Ss in the other motive groups. All three hypotheses were confirmed at p less than .05.

68 Bitzer, Donald L. PLATO: AN ELECTRONIC TEACHING DEVICE. In: Simulation models for education. Fourth Annual Phi Delta Kappa Symposium on Educational Research. Phi Delta Kappa, 151, 1965.

69 Bitzer, Donald L. and J.A. Easley, Jr. PLATO: A COMPUTER-CONTROLLED TEACHING SYSTEM. In: Computer augmentation of human reasoning, Margo A. Sass and William D. Wilkinson, (Eds.), Spartan Books, 89-103, 1964.

This article describes several programs and the associated equipment for teaching students on-line, in the absence of an instructor. The computer and each student have a two-way communication via TV display and electronic keyset. The students are permitted to proceed through and pose questions pertinent to the lesson material, independent of each other. Tutorial and inquiry logics are discussed. Presenting the technique for the allocation of computer time in the system would have been worthwhile.

70 Bitzer, Maryann. SELF-DIRECTED INQUIRY IN CLINICAL NURSING INSTRUCTIONS BY MEANS OF THE PLATO SIMULATED LABORATORY. University of Illinois Coordinated Science Laboratory Report No. R-184, 1963.

Description of a teaching method for student nurses based on computer simulation of a patient. The PLATO computer-based teaching system presented questions about treatment of a patient. Ss could instruct the computer to provide a specified treatment for the simulated patient and to report the results in the form of standard medical tests. The S's interpretations of simulated test results could then be used to answer required questions. Six student nurses who were taught by this method the care of patients with angina pectoris and myocardial infarction had significantly higher scores ($P=.09$) on a written posttest than did seven Ss taught by classroom methods.

71 Blackwell, D. and M.A. Girschik. THEORY OF GAMES AND STATISTICAL DECISIONS. Wiley, 1954.

Discussed is how decision theory applies to statistical problems; and the principle that a statistical procedure should be evaluated by its consequences in various circumstances. Also discussed are topics in Game Theory relevant to statistics.

72 Blake, D.V. and A.M. Uttley, (Eds.). PROCEEDINGS OF THE SYMPOSIUM ON MECHANIZATION OF THOUGHT PROCESSES. London, HMSO, 1959.

73 Blake, R.R. and J.W. Brehm. THE USE OF TAPE RECORDINGS TO SIMULATE A GROUP ATMOSPHERE. In: *Small Groups*, Paul A. Hare, (Ed.). Knopf, Inc., New York, 220-225, 1955.

74 Blanchard, R.E., M.B. Mitchell, and R.L. Smith. LIKLIHOOD OF ACCOMPLISHMENT SCALE FOR A SAMPLE OF MAN-MACHINE ACTIVITIES. Dunlap and Associates, Santa Monica, California, Contract No. Nonr-4314(00), June 1966.

A detailed report of how the IOTA (Index of Task Accomplishment) values were derived, and the recommended method of converting these to a Likelihood-of-Accomplishment Scale.

The appendices are: (A) Stimulus Activities and Descriptive Data, (B) Judge's Instruction Booklet, and (C) Computer Programming Procedures for Analyzing Paired Comparison Data.

75 Blau, J.H. SOCIAL CHOICE FUNCTIONS AND SIMPLE GAMES. *Bulletin of American Mathematical Society*, 63, 243-244, abstract, 1957.

76 Blaxall, J. GAME LEARNING AND DISADVANTAGED GROUPS. Abt Associates, Inc., Cambridge, Massachusetts, Unpublished paper, 1965.

77 Blaxall, John. MANCHESTER. Abt Associates, Inc., Cambridge, Massachusetts, Mimeographed paper, 1965.

A description of a game developed as part of a unit on the Industrial Revolution in England, intended for 10th to 12th grade students.

78 Block, H.D. LEARNING IN SOME SIMPLE NON-BIOLOGICAL SYSTEMS. *American Scientist*, 53(1), 59-79, 1965.

A description of reward and punishment learning based on the games "last one loses" (match drawing) and "even wins". It is written for the layman in strictly nontechnical terms and demonstrates learning in a number of simple machines made from tumblers containing numbered cards. Playing against these machines is suggested as a kind of party game.

79 Block, H.D. PERCEPTRON: A MODEL FOR BRAIN FUNCTIONING. Revised Modern Physics 34 (1): 123-135, January 1962.

80 Bloomer, R.H. SKILL GAMES TO TEACH READING. Dansville, New York: Owen Publishing Co., 1961.

81 Bloomfield, L.P. and N.J. Padelford. THREE EXPERIMENTS IN POLITICAL GAMING. American Political Science Revised, 53, 1105-1115, 1959.

82 Bogdanoff, E. et al. SIMULATION: AN INTRODUCTION TO A NEW TECHNOLOGY. TM-499. System Development Corporation, Santa Monica, March 1960.

The history, application, theoretical base, and potential of the field of simulation.

83 Boguslaw, Robert. THE NEW UTOPIANS, A STUDY OF SYSTEM DESIGN AND SOCIAL CHANGE. Prentice-Hall, 1965.

In studying problems in the analysis and design of comtemporary large-scale computer-based command and control systems, the author emphasizes the underlying effect of social theorists in the Utopian tradition.

84 Boguslaw, Robert, Robert H. Davis, and Edward B. Glick. A SIMULATION VEHICLE FOR STUDYING NATIONAL POLICY FORMATION IN A LESS ARMED WORLD. Behavioral Science, 11 (1), 43-61, 1966.

Problems of predicting the future under unknown or unanticipated social and psychological conditions involve basic issues in the processes of negotiation behavior, such as: If a particular course of action is adopted, how will the environment respond? Given the social pressures and human prejudices that are operative, what is feasible? Would some other course of action be more productive for the nation as a whole or for some particular interest groups? A simulation vehicle and supporting experiments to study these problems are presented.

85 Boguslaw, R. and W. Pelton. STEPS: A MANAGEMENT GAME FOR PROGRAMMING SUPERVISORS. Datamation, 5 (November-December 1959), 13-16. (Also, SP-65, System Development Corp., 1959).

86 Boguslaw, R. and W.J. Pelton. STEPS: STAFF TRAINING EXERCISE FOR PROGRAMMING SUPERVISORS. Model 1, TM-321, System Development Corp., 1959.

87 Bolton, Dale L. FEEDBACK IN A SELECTION OF TEACHING SIMULATION. Paper presented at the February 1967 meeting of the AERA, New York.

This discussion proposes to identify the elements in the teacher-selection decision process, to illustrate how this process can be simulated, and to indicate how the simulation may be used to provide feedback to person learning to make teacher-selection decisions.

88 Bolton, Dale L. VARIABLES AFFECTING DECISION MAKING IN THE SELECTION OF TEACHERS. Mimeographed paper.

Description of the utilization of a simulated situation for the purpose of controlling certain variables, affecting decision making in the selection of teachers, while manipulating others. The effect of various information formats on decisions made in the selection of teachers is studied.

89 Bond, J.H. USING SIMULATION TECHNIQUES TO CHANGE ATTITUDES OF EDUCATION MAJORS TOWARD PROFESSIONAL COURSE OBJECTIVES. NDEA OE-7-47-0000-239, Project #1247, Oregon State System of Higher Education, Monmouth, Oregon, 1965. 33pp.

The primary objective was to attempt to determine the effects of a classroom simulation on the attitudes of education majors toward topics in educational psychology. In general, the findings of the project are not sufficiently conclusive to permit any clear-cut recommendations of procedure. However, a trend was noted toward positive change when simulated experiences are included as a part of instruction.

90 Bonini, C.P. SIMULATION OF INFORMATION AND DECISION SYSTEMS IN THE FIRM. Prentice, 1963.

91 Bonini, Charles P. SIMULATION OF ORGANIZATIONAL BEHAVIOR. In: Management controls: new directions in basic research, 91-102.

This paper reports on some rather surprising effects observed from a computer simulation model of a business firm when explicit cognizance is taken, in the model, of the "general relationship between the pressure felt by an individual decision maker and the overall level of his performance." Thus, for example, the author finds that "the firm in a highly variable environment, had lower costs, higher sales, and greater profits than when the environment was relatively stable." He explains: "Variability kept the firm 'on its toes' and more likely to take advantage of cost and market opportunities when the occasion arose."

The author considers this work as only a first step in a comprehensive study of business organizational behavior, but feels that his results already "raise important questions for management control theorists." This reviewer agrees. For less enthusiastic views, see, however, the discussions of this paper by Conway, Hoggatt and Sprawls which appear on pp. 140-148 of the same volume (CR Rev. 7526).
A.C. Williams, Princeton, New Jersey

92 Boocock, Sarane S. THE EFFECTS OF GAMES WITH SIMULATED ENVIRONMENTS UPON STUDENT LEARNING. Baltimore: The Johns Hopkins University, Department of Social Relations, 1966. (Unpublished Doctoral Dissertation)

Current educational philosophy of games is based upon a sociological analysis of American secondary education, in which certain structural defects are suggested: a rigid and non-functional reward system; a mismatching of time, with the school oriented toward future events and rewards which are meaningless to the adolescent student; and over-emphasis on the "judging" aspect of the teacher's role. Games with simulated environments are postulated as one means of correcting these defects. There is also some evidence that performance in games is not necessarily related to performance on standard tests and on other kinds of class work, which suggests that this technique may be particularly valuable for students who do not perform well on more conventional kinds of school work.

93 Boocock, Sarane S. AN EXPERIMENTAL STUDY OF THE LEARNING EFFECTS OF TWO GAMES WITH SIMULATED ENVIRONMENTS. American Behavioral Scientist 10 (2), 8-17, Part I, 1966.

Data from two games provide evidence that games do effect changes in players: including increase in role empathy, learning of factual information and greater feelings of efficacy.

94 Boocock, S.S. EFFECTS OF ELECTION CAMPAIGN IN FOUR HIGH SCHOOL CLASSES. Baltimore, Maryland: The Johns Hopkins University, Report No. 1, Research Program in the Effects of Games with Simulated Environments in Secondary Education, 1963.

95 Boocock, S.S. and J.S. Coleman. GAMES WITH SIMULATED ENVIRONMENTS IN LEARNING. Social Education 39 (3), 215-263, Summer 1966.

In an attempt to meet certain stated criticisms of American secondary education, games with simulated environments were tried with above-average California 4-H Conference attendants. The three games involved planning a career, reacting to a community disaster, and acting as a legislator. Evaluative procedures found attitude changes, gains in information, and great motivation. Less than 10% reacted negatively to the games.

96 Borko, H. COMPUTER SIMULATION OF NEUROPHYSIOLOGICAL AND SOCIAL SYSTEMS. Behavioral Science, 7 (3), 407-412, 1962.

This paper discusses the use of the computer as a simulation device for the study of complex neurophysiological and social systems. It describes some of the interesting developments taking place in the field of computer simulation throughout the country. Areas covered are decision-making -- small group behavior --, and simulation of international relations and diplomacy. Simulation, especially computer simulation, provides a rigorous framework in which to express and test theories about behavior in the real world.

97 Bouricius, W.G. and J.M. Keller. SIMULATION OF HUMAN PROBLEM-SOLVING. In: Proceedings of the Western Joint Computer Conference, 116-119, March 3-5, 1959.

Simulating human problem-solving on a digital computer looks deceptively simple. All one must do is program computers to solve problems in such a manner that the computer employs the identical strategies and tactics that humans do. This will probably be as simple in theory and as hard in actual practice as was the development of reliable digital computers. This paper describes a few of the pitfalls that seem to lie in the path of anyone trying to program machines to "think" and gives the results of two experimental programs in some detail.

98 Brain, A.E. THE SIMULATION OF NEURAL ELEMENTS BY ELECTRICAL NETWORKS BASED ON MULTI-APERTURE MAGNETIC CORES. Stanford Research Institute, Menlo Park, California, 1960.

99 Braithwaite, R.B. THEORY OF GAMES AS A TOOL FOR THE MORAL PHILOSOPHER. Cambridge: Cambridge University Press, 1955, 1964.

This book is devoted to the thesis that if two individuals who find themselves in a competitive situation can evaluate, on a relative scale, their individual preferences as to the outcome of the situation, then the theory of games can be applied to provide an optimum resolution. Three basic resolutions are possible: a) the most sensible non-competitive solution; b) the most prudent competitive solution; and c) in the case that the protagonists are willing to cooperate to their mutual advantage, the fairest mutual solution.

100 Briggs, George E. and James C. Naylor. TEAM VERSUS INDIVIDUAL TRAINING, TRAINING TASK FIDELITY, AND TASK ORGANIZATION EFFECTS ON TRANSFER PERFORMANCE BY THREE-MAN TEAMS. Journal of Applied Psychology, 49(6), 387-392, 1965.

Transfer performance of teams was measured in a simulated radar-controlled aerial intercept task. Superior performance occurred after training on an independently organized task (as compared to that after training which required verbal interaction among controllers), and superior performance occurred in an independently organized transfer task. However, these two variables interacted such that performance on an interaction condition of the transfer task was equivalent to that on an independently organized task if prior training was under the independent task organization. Training task fidelity influenced performance only on the interaction transfer task, with superior performance following a high-fidelty training situation in which controllers could acquire the same skills to be required in transfer for communication to interceptor pilots.

101 Brody, R.A. SOME SYSTEMATIC EFFECTS OF THE SPREAD OF NUCLEAR WEAPONS TECHNOLOGY: A STUDY THROUGH SIMULATION OF A MULTINUCLEAR FUTURE. A report on research supported by the Air Force Office of Scientific Research, Office of Aerospace Research, U.S. Air Force, Contract AF 49 (638) - 742 and Research Grant AF - AFOSR 95-63 (February 1963).

102 Brooks, L.O. NOTE ON REVISING INSTRUCTIONAL PROGRAMS. American Institutes for Research in the Behavioral Sciences, Palo Alto, California, January 1967. (AD 651 490)

An 'identified point' scatter diagram may aid in program revision. Response times and error rates for program items are first obtained during laboratory study and then expressed as _z_ scores. Pairs of _z_ scores are plotted as points which are numbered according to the program item upon which each pair is based. The discrepancy of each point can be viewed from the location it would have occupied in the special case of perfect linear correlation. Discrepant would be the frequently incorrect, quickly answered item or the slowly but correctly answered item. These, especially, would deserve consideration in relation to the programmer's intent. Perhaps discrepancies between these or other measures of task difficulty for other tasks could also help guide task redesign. (Author)

103 Brotman, L. and J. Minker. COMPUTER SIMULATION OF A COMPLEX COMMUNICATIONS SYSTEM. (Abstract) OR JORSA, 5 (1), February 1957.

104 Brown, R.G. AN INVENTORY-CONTROL SIMULATION. Arthur Little, Inc., New York, February 1958.

105 Brown, R.G. A GENERAL-PURPOSE INVENTORY-CONTROL SIMULATION. Report of System Simulation Symposium, D.G. Malcolm, (ed.). Waverly Press, Baltimore, 1957.

106 Buchin, Stanley I. THE HARBETS SIMULATION EXERCISE AND MANAGEMENT CONTROL. In: Management controls: new directions in basic research, 127-139. Charles Bonini, and others (eds.) McGraw-Hill, 1964.

This is a progress report on an experimental investigation into executive decision-making behavior. The method is to study the decision-making behavior of about one hundred business and government executives in a computer-generated environment simulating the real world of business. The paper is mainly concerned with a description of the experimental set-up. As far as results, interpretation, and evaluation of the method are concerned, only a very few general and carefully hedged statements are made, as is appropriate for a progress report.

The simulated environment is as follows: "The task assigned to these executives is the management of a medium-sized manufacturing firm, the Harbets Company, with sales of about $25,000,000 per year of industrial non-durable goods, namely, grinding wheels. Each participant is given a specific role: marketing vice-president, manufacturing vice-president, director of research and engineering, or comptroller. Not only is each participant responsible for the operation of his own part of the company, but each four-man team has been asked by the company president in a memorandum to act collectively as an executive committee. During their two week involvement in the simulation exercise, the executives guide their company through two years of operations with the opportunity to change plans and policies every three months (one day of real time being equal to three months of simulated time).

"Management control is performed by written response to various budgets, reports correspondence, and memoranda found by the participants in their in-baskets each morning. Some of these materials are generated by a computer model of the firm and its environment (Harbus 2) based on the existing company policies and the current and predicted economic conditions. The rest are typical of that found at the prototype company, Bay State Abrasive Products Company and are assigned to particular in-baskets according to the research design. They vary in problem generality, probably impact on company operations, search required for information necessary for solution, and apparent time pressure for a response. Also available to the participants are computer-generated reports on the last three months of operations to provide indications of how successful past decisions were and how competition and customers seemed to be responding to these past decisions."

Tentative conclusions: "Even at this stage of analysis, one particular interesting result that seems to be emerging is the strong relationship between an understanding of quantitative reports and prudent management control (at least in a situation new to an executive). Management planning and control appeared to be an inseparable process assisted by an intelligent use of quantitative information."

A.C. Williams, Princeton, New Jersey

107 Buckhout, Robert, James C. Naylor, and George E. Briggs. EFFECTS OF MODIFIED TASK FEEDBACK DURING TRAINING ON PERFORMANCE OF A SIMULATED ATTITUDE CONTROL TASK AFTER 30 DAYS. USAF AMRL TDR, 63-125.

This study was to determine the effects of modifications in task feedback during training on performance of a simulated attitude control task which consisted of compensatory rate tracking in three dimensions by means of "noisy" meter displays and a conventional stick with a twist dimension added. In addition, the intensity of auditory noise present varied proportionately to tracking error in four steps. Equal numbers of Ss were trained for one or three weeks with either noisy or non-noisy displays and under one of two degrees of auditory feedback specificity (magnitude of steps used to relate visual noise to error score). Ss trained with visual noise showed better performance after 30 days despite the fact that Ss trained with a noise-free display performed significantly better during training. The Ss trained for three weeks showed significantly better tracking performance on 30-day retention tests than Ss who received only one week of training. The use of more gross steps in auditory noise in training did not significantly affect retention test performance.

108 Burns, Arthur J. and Richard E. Kopp. COMBINED ANALOG-DIGITAL SIMULATION. In: Computers: Key to total systems control. Eastern Joint Computer Conference, 20, 114-123, 1961.

The missile intercept simulation with its associated scaling and expensive computer time problems exemplifies only one area where a combined analog-digital technique is useful. Computer controlled systems that are presently envisioned for future aircraft, missiles, and other space vehicles will require the handling of discrete and continuous information. Hybrid computation is the logical choice for the simulation of these inherently hybrid systems. Since an analog-digital computer link is by nature a sampled-data device it is a valuable tool for research in sampling theory. Stability studies and error analyses are planned using the hardware to simulate the sampled data-system under investigation.

109 Bushnell, Donald D. COMPUTER-BASED SIMULATION: A NEW TECHNOLOGY FOR EDUCATION. AV Communication Review, 11, 45-55, 1963.

A brief and concise history of simulation, its application to education, its advantages and problems.

110 Caillois, R. MAN, PLAY, AND GAMES. New York: Free Press, 1961.

111 Carlson, E. GAMES IN THE CLASSROOM. Saturday Review, 50(15), 62-65, 82-83, April 1967.

A general overview of educational gaming mentioning several authorities and some of the better known games.

112 Caro, Paul W., Jr. HELICOPTER TRAINING DEVICES IN SUPPORT OF ARMY AVIATION. Human factors research in support of Army Aviation: A report from three laboratories. HumRRO Division No. 6 (Aviation), Fort Rucker, Alabama. Paper presented at Southeastern Psychological Association 13th Annual Meeting, Atlanta, Georgia, 13-15, April 1967.

A description of devices employed in operator training for Army aviation which provide dynamic simulation of the procedural, psychomotor, and time sharing tasks of helicopter pilots.

113 Caro, Paul W., Jr. SOME IMPLICATIONS OF DIGITAL COMPUTER ADVANCES FOR ARMY SIMULATION REQUIREMENTS. Staff paper, Task ECHO: Subtask III, HumRRO Division No. 6, June 1965.

HumRRO Division No. 6 (Aviation) is engaged in a research program under Task ECHO which is concerned with the development and effective utilization of synthetic flight equipment. In accord with guidance provided for this Task by the Commanding General, U.S. Army Aviation Center (USAAVNC), to look fully into the potential for use by the U.S. Army Aviation School (USAAVNS) and Army aviation training of the latest state-of-the-art advances, automation of training, and features such as visual simulation of the contact world, the information in this paper was assembled. The paper deals with the effect of recent advances in computer simulation technology upon USAAVNS' requirements for synthetic flight training equipment.

114 Caro, Paul W., Jr. and Robert N. Isley. CHANGES IN FLIGHT TRAINEE PERFORMANCE FOLLOWING SYNTHETIC HELICOPTER FLIGHT TRAINING. Presentation at Twelfth Annual Meeting Southeastern Psychological Association, New Orleans, Louisiana, April 1966, (Professional Paper 1-66).

This paper describes research performed by HumRRO Division No. 6 (Aviation), Fort Rucker, Alabama, under Subtask II of Task ECHO. Task ECHO is a series of studies of synthetic flight training programs and devices. This paper deals with one aspect of one of these studies -- a determination of the training value of certain training device concepts and techniques in Army helicopter contact flight training. Another phase of this same study, dealing with predictive value of performance on the devices in relation to subsequent performance in the aircraft, is nearing completion. Military support for the research reported here was provided by the U.S. Army Aviation Human Research Unit and the U.S. Army Helicopter School.

115 Carter, L.F. EXERCISING THE EXECUTIVE DECISION-MAKING FUNCTION IN LARGE SYSTEMS. In: Training Research and Education. R. Glaser, (ed). Wiley, 409-427, 1962.

116 Casperson, R.C. and R.C. Channell. USE OF THE OPERATIONAL FLIGHT TRAINER. Dunlap and Associates, Inc., Stanford, Connecticut, for Naval Training Device Center, May 1957.

In order to improve the design of training devices, an analysis is made of instructor activity in operational flight trainers.

117 Caywood, T. and J. Caviness. DIGITAL SIMULATION OF VIGILANTE FIRE-CONTROL. Caywood-Schiller, Associates, Chicago, Illinois, 1959.

118 Chambers, R.M. DYNAMIC SIMULATION FOR SPACE FLIGHT. WHAT NEEDS DOING ABOUT MAN-IN-SPACE? Human Factors Engineering, Biosciences Operations, Missile and Space Vehicle Department, General Electric Company, Philadelphia, Pennsylvania, 1959.

119 Chapanis, A. MEN, MACHINES AND MODELS. American Psychologist, 16, 113-131, 1961.

120 Chapman, Laura Hill. PRELIMINARY WORK: AN EDUCATIONAL THEORY BASED ON GAME THEORY. Occasional paper 64-170. Bureau of Educational Research and Service, The Ohio State University.

A description of teaching as a game -- the point is to formulate problems so the student can solve them and will solve -- "can" refers to readiness of the pupil to solve the problems because he has sufficient background in the content to do so; "will" refers to motivation.

121 Chapman, Robert L. THE CASE FOR INFORMATION SYSTEM SIMULATION. In: Proceedings of the Second Congress on the Information System Sciences. Spartan Books, 477-484, 1965.

Defines and categorizes the various arguments for and against simulating information systems, and essentially sets the scene for the rest of the papers presented at the Information System Simulation and Modeling session of the Second Congress of the Information System Sciences, held in November 1964.

122 Chapman, R.L. DATA FOR TESTING A MODEL OF ORGANIZATIONAL BEHAVIOR. U.S. Air Force Project RAND Research Memorandum, The RAND Corporation, Santa Monica, California, March 1960.

123 Chapman, R.L. SIMULATION IN RAND'S SYSTEM RESEARCH LABORATORY. Report of System Simulation Symposium, D.G. Malcolm (Ed.). Waverly Press, Baltimore, 1957.

124 Chapman, R.L., et al. THE SYSTEM'S RESEARCH LABORATORY'S AIR DEFENSE EXPERIMENTS. Management Science, 5, 250-269, 1959.

125 Cherryholmes, Cleo H. DEVELOPMENTS IN SIMULATION OF INTERNATIONAL RELATIONS FOR HIGH SCHOOL TEACHING. Unpublished Master's thesis, Kansas State Teachers College, Emporia, 1963. Phi Delta Kappan 46, 227-231, 1965.

The simulation described has been used to present the basic concepts of international relations -- e.g., balance-of-power, sovereignty, international law -- and has provided a basis for discussion of decision-making and communications theory. Simulation seems to arouse keen student interest and apparently tends to produce a pragmatic set of attitudes toward international relations.

126 Cherryholmes, Cleo H. INSTRUCTIONS FOR PARTICIPANTS: SIMULATION OF INTERNATIONAL RELATIONS. Kansas Institute on International Affairs, Kansas State Teachers College of Emporia, Division of Social Sciences, 1964.

A description of a simulation experiment which has two goals: (1) to enliven the process of learning about decision-making, and (2) to provide the student with an opportunity of obtaining a vicarious experience through his involvement with the problems of fictitious nations, leading him to an understanding of the serious matters of public affairs, including those of war or peace, butter or guns, democracy or dictatorship.

127 Cherryholmes, Cleo H. SOME CURRENT RESEARCH ON EFFECTIVENESS OF EDUCATIONAL SIMULATIONS: IMPLICATIONS FOR ALTERNATIVE STRATEGIES. American Behavioral Scientist, 10(2), 4-7, October, 1966.

128 Chicago Public Schools. COMMUNICATION SKILLS: GAMES, TECHNIQUES AND DEVICES FOR KINDERGARTEN, GRADES 1, 2, 3. Chicago, Illinois, 1964.

129 Chorafas, D.N. SYSTEMS AND SIMULATION. Academic Press, New York, 1965.

Explains the theory and application of mathematical simulation in man-made systems.

130 Churchill, Neil C., Merton H. Miller and R.M. Trueblood. AUDITING, MANAGEMENT GAMES, AND ACCOUNTING EDUCATION. Monograph No. 2 in the Carnegie Institute of Technology Series on Contributions to Management Education. Richard D. Irwin, Inc., Homewood, Illinois, 1964.

A description of how a modern audit can be applied and implemented in a game environment; the audit project itself (the formal training given the student auditors and the nature and timing of the various phases of the project) as it is being utilized at Carnegie Tech under a large-scale educational experiment in the teaching of auditing and accounting.

131 Clark, D.L., J. Kane, and M. Wallace. THE NORAD DESK TOP CPX: A HISTORY OF A LARGE-SCALE SYNTHETIC EXERCISE. Technical Memo, TM-1830/000/01. System Development Corporation, Santa Monica, June 1964.

Review of a large-scale, synthetic, command post exercise (CPX) series, "DESK TOP." Initial chapter surveys current structure and function of North American air defense (i.e., joint U.S. and Canada air defense organization collectively called NORAD) treated as a military command/control system. Subsequent chapter discusses systems concepts underlying NORAD-wide command post simulation, showing evolution of DESK TOP from the System Development Corporation-developed "System Training Program" (STP) utilized by Manual and SAGE air defense systems. Two chapter describe DESK TOP CPX's produced to 1964, with observations on analyses of each mission relevant to NORAD system effectiveness. Concluding chapter considers direction large-scale exercising might follow through changing technology and dynamics affecting weaponry, NORAD configurations, etc. Text contains four maps and four diagrams; appendix contains Glossary and Bibliography (108pp).

132 Clarkson, G.P.E. PORTFOLIO SELECTION: A SIMULATION OF TRUST INVESTMENT. Prentice-Hall, 1961.

133 Clarkson, G.P. and H.A. Simon. SIMULATION OF INDIVIDUAL AND GROUP BEHAVIOR. American Economic Review. 50(5), 920-932, 1960.

This paper places special emphasis on mico-economic simulation -- especially the simulation of individual economic actors and individual firms -- and methods for using simulation to study various aspects of an economic system. One of the things simulation techniques permit the economist to see is whether the decision-making processes that can be observed in the executive and the individual business firm correspond to the postulates about process that can be incorporated in models.

134 Cogswell, John F. CLINICAL DIAGNOSTIC MODELS VIA COMPUTER SIMULATION. Report Number SP-976, System Development Corporation, Santa Monica, September 1962.

An automated system for simulating functions used in psychological diagnosis and the simulation technique as a conceptual tool for empirical model-construction in constructing psychological models for predicting behavior are discussed.
The word simulation is used to mean that the machine system performs the behavior usually carried out by the human diagnosticians. The computerized system that automatically performs the functions of data

storage, clinical interviewing, diagnostic analysis, and report writing is described. The use of this computerized system as a simulation device for a research project is discussed. The iterative approach of model construction and the testing of the sucessive models will provide valuable information about the potential use of computer simulation as a conceptual tool.

135 Cogswell, John F. SYSTEMS ANALYSIS AND COMPUTER SIMULATION IN THE IMPLEMENTATION OF MEDIA. Audio-Visual Instructor, 10, 384-386, 1965.

This article describes a project underway at System Development Corporation which is making use of techniques relatively new to educational research -- systems analysis and computer simulation. The purpose of the research is to find new solutions to implementing instructional media through analysis and simulation of school organization.

136 Cogswell, J.F., et al. CONSTRUCTION AND USE OF THE SCHOOL SIMULATION VEHICLE. Journal of Educational Measurement. 2(1), 5-14, 1965.

This paper describes the construction of a computer-simulation vehicle that will provide the capability of building detailed, dynamic models of a real or proposed high school and of hypothetical changes in the school organization.

137 Cogswell, J.F., et al. NEW SOLUTIONS TO IMPLEMENTING INSTRUCTIONAL MEDIA THROUGH ANALYSIS AND SIMULATIONS OF SCHOOL ORGANIZATION. Technical Memorandum TM1809, Systems Development Corporation, Santa Monica, 1964.

A study of the use of systems analyses and computer simulation to provide techniques and design recommendations that are more carefully conceived, that involve more pervasive and integrated changes throughout the schools, and that employ instructional media more effectively than do current school-design methods.

138 Cogswell, J.F., et al. ANALYSIS OF INSTRUCTIONAL SYSTEMS. Final Report, System Development Corporation, TM-1493/201/00, Santa Monica, California and U.S. Department of Health, Education and Welfare, Office of Education, April 1966.

A report of the project which explored uses of systems analysis and computer simulation in public secondary schools; resulted in the identification of two ways for using system analysis in education: (1) to facilitate improvement of present instructional and educational planning systems, and (2) to explore the feasibility of proposed school organizations. These findings resulted from the employment of systems analysis methods in 11 studies at 6 selected secondary schools. The study recommends procedures for system analysis that involve defining the major overall problems to be solved by the system, modeling the system, and drawing implications from the model relative to the purposes of the system. A technique for modeling a system by means of a computer program was developed as part of the project.

139 Cohen, Bernard C. POLITICAL GAMING IN THE CLASSROOM. Journal of Politics, 24, 367-381, 1962.

Describes the various forms of simulation that are being developed in political science; emphasis here is given to "reality" games in which players take the parts of real-life decision-makers in particular countries, working their way through realistic problems as they are introduced.

140 Cohen, K.J. COMPUTER MODELS OF THE SHOE, LEATHER, HIDE SEQUENCE. Prentice-Hall, 1960.

141 Cohen, K.J. COMPUTER SIMULATION, SOME METHODOLOGICAL PROBLEMS. Carnegie Institute of Technology, Graduate School of Industrial Administration, Pittsburgh, Pennsylvania, 1959.

142 Cohen, K.J. THE EDUCATIONAL USES OF MANAGEMENT GAMES. In: Data Processing Yearbook, 1962-1963, American Data Processing, Inc., Detroit, Michigan, 135-142, 1963.

This paper discusses and describes the manner in which business decisions games are developing and will be used for management training purposes in future years. Complex games can serve as frameworks around which many aspects of a mangement training program can properly be organized.

143 Cohen, Kalman J. SIMULATION OF THE FIRM. American Economic Review, 50(5), 534-540, 1960.

This paper describes the main advantage of using computer simulation as a tool in economics as providing concrete procedure for formulating and testing hypotheses. The argument is made here that this new methodology offers promise for exploring the causal mechanisms which govern the behavior of individual firms.

144 Cohen, K.J. and R.M. Cyert. SIMULATION OF ORGANIZATIONAL BEHAVIOR. In: *Simulation models for education*. Fourth Annual Phi Delta Kappa Symposium on Educational Research. *Phi Delta Kappa*, 105, 1965.

145 Cohen, K.J. and R.M. Cyert. COMPUTER MODELS IN DYNAMIC ECONOMICS. *Quarterly Journal of Economics*, 75(1), 112-127, 1961.

Describes and discusses the nature of computer models, the associated methodological problems, and some of the current literature utilizing computer models. Basic advantage of computer models is that they provide a language within which complex dynamic models can be constructed. Once the model is simulated, a more rigorous test of the validity of the model can be made by comparing the time series generated by the model against the actual observed behavior of the system.

146 Cohen, K.J. TRENDS IN THE EDUCATIONAL USES OF MANAGEMENT GAMES, BEHAVIORAL THEORY OF THE FIRM. Working Paper 37, Carnegie Institute of Technology, Pittsburgh, March 1962.

147 Cohen, K.J. and M.H. Miller. THE CARNEGIE TECH MANAGEMENT GAME AS A PERVASIVE EDUCATIONAL TOOL. Dill, W.R., J.R. Jackson and J.W. Sweeney (Eds.) Proceedings of the Conference on Business Games as Teaching Devices. Tulane University, School of Business Administration, New Orleans, 48-55, April 1961.

148 Cohen, K.J. and Merton H. Miller. MANAGEMENT GAMES, INFORMATION PROCESSING AND CONTROL. *Management International*, 3(3/4), 159-177, 1963.

Training in decision-making cannot produce the "complete" executive, and the concentration upon it in business gaming to date cannot be justified. The information processing function, and the implementation of decisions are not included in most existing business games. The authors suggest some ways in which these might be improved.

149 Cohen, K.J. and E. Rhenman. THE ROLE OF MANAGEMENT GAMES IN EDUCATION AND RESEARCH. Management Science, 7(2) 131-166, 1961. (Behavioral theory of the firm working paper #22, Graduate School of Industrial Administration, Carnegie Institute of Technology, September 1960.)

This paper is a broad survey of both the present and the potential role of management games in education and research. Discussion of the educational aspects of management games. The various types of research for which management games may be used are described.

150 Cohen, Kalman J., et al. THE CARNEGIE TECH MANAGEMENT GAME: AN EXPERIMENT IN BUSINESS EDUCATION. Richard D. Irwin, Homewood, Illinois, 1964.

A detailed description of the Game, a summary of ways in which the authors and others have used it, instructions for the administrator, and the materials which the administrator needs to put the Game on the computer, are all discussed and described.

151 Cohen, K.J., et al. THE CARNEGIE TECH MANAGEMENT GAME. Journal of Business, 33(4), 303-321, 1960.

The constitution and rules of the Carnegie Tech game are described and its use in improving managerial skills evaluated. The role of the game in research is discussed.

152 Coleman, J.S. IN DEFENSE OF GAMES. American Behavioral Scientist, 10(2), 3-4, October 1966.

153 Coleman, James S. THE ADOLESCENT SOCIETY. The Free Press, Glencoe, Illinois, 1961.

"Dr. Coleman suggests that competitive games can be used, not only as a new mode for learning, but also as a means for positive reconstruction of the present system of adolescent values and peer rewards within the schools."

154 Coleman, James S. ANALYSIS OF SOCIAL STRUCTURES AND SIMULATION OF SOCIAL PROCESSES WITH ELECTRONIC COMPUTERS. Educational and Psychological Measurement, 21(1), 203-218, 1961.

For the analysis of social structure in large groups, computers can be used to (a) determine cliques, (b) obtain reference group phenomena, and (c) determine the direction in which popular heroes may be pulling the group. Through simulation analyses may be made of (a) stability and instability in three-person groups, (b) business firm behavior, (c) community conflicts, and (d) voting behavior. Examples of all these uses are discussed and the programming involved outlined in some cases.

155 Coleman, James S. LEARNING THROUGH GAMES. National Education Association Journal, 56, 69-70, 1967.

A description of games that can be used in the schools, and an introduction to the use of games as learning devices at all educational levels. Dr. Coleman suggests that the development of academic simulation games may force educators to look at new approaches to learning in school that more nearly approximate the natural processes through which learning occurs outside school.
In the rejoinder by Kraft, the idea that social studies are appropriate subject matter for game playing is rejected. Says Kraft, "few if any students will acquire a deeper understanding of social processes by playing games of the kind developed at Johns Hopkins."

156 Coleman, James S., Sarane S. Boocock and E.O. Schild. (Eds.) SIMULATION GAMES AND LEARNING BEHAVIOR (Part I). American Behavioral Scientist, 10(2), 1-32, 1966.

A complete issue of American Behavioral Scientist devoted to simulation and learning behavior. Includes articles as follows:
Coleman, James S. In defense of games.
Cherryholmes, Cleo H. Some current research on effectiveness of educational simulations: Implications for alternative strategies.
Boocock, Sarane S. An experimental study of the learning effects of two games with simulated environments.

Inbar, Michael. The differential impact of a game simulating a community disaster.
McKenney, James L. and William R. Dill. Influences on learning in simulation games.

157 Coleman, James S., Serane S. Boocock and E.O. Schild (Eds.) SIMULATION GAMES AND LEARNING BEHAVIOR. (Part II). American Behavioral Scientist, 10(3), 1-36, 1966.

The second part of a two-section entire-issue project devoted to simulation and learning behavior.
Contents:
Schild, E.O. The shaping of strategies.
Kinley, Holly J. Development of strategy in a simulation of internal revolutionary conflict.
Rapoport, Anatol and Albert M. Chammah. The game of chicken.
Starbuck, William H. and Ernest Kobrow. The effects of advisors on business game teams.
Wing, Richard L. Two computer-based economics games for sixth graders.
Selective bibliography on Simulation games as learning devices.

158 Colley, J.L., Jr. SIMULATION AS A PRODUCTION AID. Journal of Industrial Engineering, 10(4), July-August 1959.

159 Conway, R.W. SIMULATION IN PROFIT PLANNING. Report of System Simulation Symposium, D.G. Malcolm (Ed.). Waverly Press, Baltimore, 1957.

160 Conway, R.W. and B.M. Johnson. PROBLEMS OF DIGITAL SYSTEMS SIMULATION. Fifth International Convention of the Institute of Management Sciences, October 1958.

161 Conway, R.W., Austin C. Hoggatt and Clay Sprowls. DISCUSSION COMMENTS: SIMULATION AND MANAGEMENT CONTROLS. In: Management controls: new directions in basic research. Charles Bonini, et al. (Eds.), 140-148, McGraw-Hill, 1964.

This is not a single paper, but rather it is a collection of three short notes, one by each of the authors; each are discussing all three of the papers on simulation which precede this collection in the book. The papers discussed are "Simulation of Organizational Behavior" by C.P. Bonini (CR7523), "Industrial Dynamics and the Design of Management Control Svstems" by E.B.

Roberts (CR7524), and "The Harbets Simulation Exercise and Management Control" by S.I. Buchin (CR7525). Conway points out that some data presented by Bonini at the seminar, but not included in his paper, make it "apparent that the model was inherently unstable." This is, seemingly, an important factor in the drawing of conclusions and is a point which this reviewer would like to see answered in print. Aside from a somewhat labored pretense on the part of Sprawls to be unable to understand how the work of Bonini and of Roberts can be compatible (Roberts shows how to damp out oscillations; Bonini shows that this may not be a desirable thing to do), very little more of substance is said concerning the content of the papers being discussed.

Each of the authors chose instead to level his main attack on the methodology of simulation. Questions concerning the applicability or the relevance of results obtained by simulation are raised--the type of question that must inevitably arise in a new discipline. Such questions are never answered promptly, as Sprawls would like, and overconcern with them can stifle progress as effectively as ignoring them.

Methodological questions can seldom be contained. Hoggatt writes: "Results are presented here which cannot be checked. . . Many hours (of debugging) have gone into the attempt to assure that the results are not obviously in error. Yet in no way is any of this accessible to the reader. . . . The programs are too extensive to be reproduced for publication. We need a better methodology! Communication failure at this level simply won't do for a discipline that calls itself a science."

If these remarks are taken at face value, it would seem that very few nontrivial disciplines would meet Hoggatt's exacting standards. For example, the disciplines of physics and chemistry, which often employ unique and complex experimental apparatus, do not meet any of the requirements. Methodological questions of a very general nature are thus raised in a situation which does not permit full development of the ideas. One may be permitted to wonder whether, under the circumstances, they should have been raised at all.

A.C. Williams, Princeton, New Jersey

162 Conway, R.W., B.M. Johnson and L. Maxwell. THE CORNELL RESEARCH SIMULATOR. Cornell University, Ithaca, New York, 1958.

163 Conway, R.W., B.M. Johnson and W.L. Maxwell. SOME PROBLEMS OF DIGITAL SYSTEMS SIMULATION. *Management Science*, 6, 92-110, 1959.

164 Cook, S. Eugene. ARTIFICIAL INTELLIGENCE. In: *Data Processing Yearbook, 1965*. American Data Processing, Inc., 1964.

A description of some of the major problems of computer approaches to simulating intelligence, and a discussion of some of the current direction of effort in the field.

165 Coplin, William D. INTER-NATION SIMULATION AND CONTEMPORARY THEORIES OF INTERNATIONAL RELATIONS. *American Political Science Review*, 9(3), 562-578, 1966.

166 Cotlerman, T.E. TASK CLASSIFICATION: AN APPROACH TO PARTIALLY ORDERING INFORMATION ON HUMAN LEARNING. Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, January 1959. (15pp. appendix included). (AD 210 716).

The purpose of the report is to put forth a task classification scheme in terms of which it would be possible to sort all human learning tasks. Task classification is seen as a possible way of making information on human learning more useable and as resulting in a number of specific advantages both for research and application purposes.

167 Covner, Bernard J. and Jesse Orlansky. TRAINING AIDS AND DEVICES. Department of Defense, Research and Development Board, Washington, D.C., June 30, 1951. (Prepared for The Working Group on Human Behavior under conditions of military service).

The report reviews the research findings and principles pertaining to training aids and devices. The purpose was to provide the armed forces with sound principles and recommendations for making effective use of training aids and devices in military training.

168 Cox, J.A., et al. FUNCTIONAL AND APPEARANCE FIDELITY OF TRAINING DEVICES FOR FIXED-PROCEDURE TASKS. Tech. Rep. 65-64. Task Ringer Hum RRO, Division #5, June 1965.

169 Craft, C.J. INTEGRATED MATERIALS MANAGEMENT SIMULATION EXERCISE. Paper presented at meeting of Association for Computing Machinery, MIT, Cambridge, Massachusetts, 1959.

170 Craft, C.J. MANAGEMENT GAMES USING PUNCHED CARDS AND COMPUTERS. Peat, Marwick, Mitchell and Company, New York, no date.

171 Craft, C.J. and Stewart. COMPETITIVE MANAGEMENT SIMULATION. The Journal of Industrial Engineering, 10(5), September-October 1959.

172 Crawford, James R. SIMULATION METHODS AND MODEL DESIGN. System Development Corporation, June 19, 1963.

> Forms, procedures and processes for a large simulation model are described. An organized method for defining terms and expressing the flow of information and products is presented. With the accounting machine processes of sort, reproduce and list, industrial engineers can use the method to analyze extensive systems and quickly implement new procedures with no conflict of instructions.

173 Crawford, M.P. DIMENSIONS OF SIMULATION. Presidential Address for Division of Military Psychology, read at meeting of APA, 1965. (Dir. Off.) Also in American Psychologist, 21(8), 788-796, 1966.

> Presents three interesting connotations of simulation: (1) representation or substitution of one thing for another; (2) portrayal of the environment, which suggests the study of perception; and (3) dynamic systems and the function of computers in their representation. Explores the uses of simulation from the point of view of research and development in training. Major sections are the field of simulation, open-loop environmental simulation, simulation not involving people, analyses of occupations, simulation for training, real-size system simulation, techniques of miniaturization, simulation with emphasis on the people involved, and simulation for proficiency measurement. Five dimensions of simulation are identified. (31 ref.)

174 Crawford, M.P. RESEARCH AND DEVELOPMENT IN TRAINING AND EDUCATION. Professional Paper 18-67. The George Washington University, Human Resources Research Office, Alexandria, Virginia, April 1967. (AD 651 931).

175 Cruickshank, D.R. SIMULATION: NEW DIRECTION IN TEACHER PREPARATION. Phi Delta Kappan, 48, 23-24, September 1966.

> Description of simulation as it is being tested to meet the criterion of realism as well as to provide a setting wherein trainees or teachers in service may practice a wider range of teaching behavior without fear of censure or failure.

176 Culbertson, Jack. SIMULATION IN ADMINISTRATIVE TRAINING. University Council for Educational Administration, Columbus, Ohio, 1960.

177 Cyert, Richard M. and James G, March. A BEHAVIORAL THEORY OF THE FIRM. Prentice-Hall, 1963.

> This book could have aptly been subtitled "Simulation and the study of the firm." Its intent is to advocate a behavioral theory, rather than classical economic theory, for the study of the decisions of the firm. The behavioral approach frequently utilizes computer simulation models to model the human decisions made in a firm. Describes the use of simulation as a research tool.

178 Dale, A.G. and C.R. Klasson. BUSINESS GAMING: A SURVEY OF AMERICAN COLLEGIATE SCHOOLS OF BUSINESS. The University of Texas, Bureau of Business Research, Austin, Texas, 1964.

This is a survey report which was undertaken to determine to what extent educational innovations, such as the use of business games as an important part in the training of future business leaders, have been used in undergraduate and graduate study programs in business schools throughout the country.

179 Dale, A.G., et al. SMALL BUSINESS EXECUTIVE DECISION SIMULATION. University of Texas, Austin, 1963.

180 Datz, I.M. SIMULATED SHIPPING. Datamation, 12(2), 61-63, 1966.

The simulation model described allows the use to study trade conditions in any areas of the world. Variables such as: proposed vessels, ship characteristics, fleet replacements, route structures, levels of service, cargo offerings, seasonal variations, and degrees of government control of cargo, may be included and evaluated in the model.

181 David, E.E., Jr. DIGITAL SIMULATION IN PERCEPTUAL RESEARCH. Bell Telephone Laboratories, Inc. Murray Hill, New Jersey. (no date).

182 David, E.E. DIGITAL SIMULATION IN RESEARCH ON HUMAN COMMUNICATION. Proceedings of the IRE, 49, 319-328, 1961.

Digital simulation is a powerful tool in uncovering the basic properties of new or proposed communications principles, particularly those involving coding of visual or auditory information. Simulation is assuming an increasing role in communication research.

183 Davis, J. PASSATELLA: AN ECONOMIC GAME. British Journal of Sociology, 15(3), 191-206, 1964.

A description of an Italian card game, the relationships between players during the game, "the relation of the game to the community at the level of the values involved in both," and the nature of the game itself. The basic relationships of the game are seen to correspond in value and function to one common friendship pattern as well as to the client-patron relationship. Some reasons for this are suggested.

184 Davis, Joan A.M. and William Taylor. TEACHING THE HEAD; SIMULATED MANAGEMENT. *The Times Educational Supplement*, 2560: 1624, June 12, 1964.

A description of an adaptation of materials, assembled during 1963 of a simulation at the University of British Columbia, to the junior school in England with which the author is associated. Principal items selected for use in the simulation experiment were the in-baskets, including letters, notes and memos dealing with selections procedures, streaming, parent-teacher relationships, teacher mobility, difficulties of young teachers, staff tensions, activity methods, discipline and the organization of the school in terms of curriculum.

185 Davis, R.H., P.B. Carpenter and C.W. Missler. A GAME FOR STUDYING THE PROBLEMS OF ARMS CONTROL. SP-799. System Development Corporation, Santa Monica, California, May 11, 1962.

186 Davis, R.H., *et al.* ARMS CONTROL SIMULATION. Technical memorandum. TM-(L)-633. System Development Corporation, Santa Monica, California, August 10, 1961.

187 Day, Ralph L. THE NONCOMPUTER DECISION GAME AS A TEACHING DEVICE FOR BUSINESS COURSES. *Collegiate News and Views*, 14(4), 17-19, 1961.

Gaming provides the student an opportunity to experience the business decision-making process in a reasonably realistic situation, as well as relief from the fundamentally historical perspective of the case study approach and allows the student to feel some of the immediacy of the business situation.

188 Deacon, A.R.L., Jr. SELECTED REFERENCES ON SIMULATION AND GAMES. (processed). AMA Academy, Saranac Lake, April 1960.

189 DeCecco, J.P., (Ed.). EDUCATIONAL TECHNOLOGY: READINGS IN PROGRAMMED INSTRUCTION. Holt, Rinehart and Winston, New York, 1964.

A group of readings divided into ten chapters covering various aspects of educational technology in general and programmed instruction in particular. Included are such topics as (1) Program sequences, (2) Stimulus factors, (3) Response mode, (4) Knowledge of results, (5) Learning objectives, (6) Individual differences, (7) Evaluation and school use, and (8) The future.

190 Deegan, Thomas J. ANALOG SIMULATION AND ANALYSIS OF A NON-LINEAR SELF-ADAPTIVE FLIGHT CONTROL SYSTEM. Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, August 1961.

An analog simulation was conducted for the longitudinal axis of the General Electric Self-Adaptive Flight Control (GESAC) System, as proposed for use on the X-15 aerospace vehicle. A method of optimizing the system simulation by first considering the non-linear loop independently is described.

191 Deep, S.D., B.M. Bass and J.A. Vaugh. SOME EFFECTS ON BUSINESS GAMING OF PREVIOUS QUASI-T GROUP AFFILIATIONS. Graduate School of Business, University of Pittsburgh, Pittsburgh, In Press.

192 Defense Documentation Center. COST: ANALYSIS AND METHODOLOGY. Operations Research Series, Volume I, Defense Documentation Center, Alexandria, Virginia, March 1967. (AD-808 900).

This bibliography is a compilation of references on Cost: Analysis and Methodology. References in the collection are concerned with identifying and estimating research and development costs, and their associated problems and possible solutions. This collection is a comprehensive listing of DDC material since 1955.

193 Defense Documentation Center. COST EFFECTIVENESS ANALYSIS. Operations Research Series, Volume III, Defense Documentation Center, Alexandria, Virginia, March 1967. (AD-808 901).

This bibliography is a compilation of references on cost effectiveness analysis which is considered to be a part of the large analytic activity called systems analysis. References are mainly concerned with research and development decison making, management problems, design trade-offs, related cost estimates, and systems value engineering. The volume represents a comprehensive compilation of DDC material catalogued since 1959.

194 Defense Documentation Center. PARAMETRIC IDENTIFICATIONS FOR COST ANALYSIS. Operations Research Series, Volume V, Defense Documentation Center, Alexandria, Virginia, March 1967. (AD-808 902).

This bibliography provides a collection of references on parameters related to cost identification and estimation in program evaluations and management techniques as well as systems operational analysis. The subject is divided into sections pertaining to Resource Analysis, Logistics and Maintenance; Management Engineering, Contracting, ad Budgeting; Missle, Space, and Weapon Technology; Aircraft and Airborne Systems; Transportation; and Miscellaneous Selections. This collection contains 286 unclassified references.

195 deGrazia, A. and D.A. Sohn (Ed.) PROGRAMS, TEACHERS AND MACHINES. Bantam Books, New York, October 1964.

The book is divided into five major sections with 34 selections on programmed instruction including Background, Programming Theory, Research and Development, P.I. for subject matter areas, and Potential of P.I.

196 deGrazia, A. and D.A. Sohn. REVOLUTION IN TEACHING: NEW THEORY, TECHNOLOGY, AND CURRICULA. Bantam Books, New York, October 1964.

The book presents thirty-one selections divided into three major sections including: (1) Theory, Challenge and Change; (2) The New Technology; and (3) The New Curricula.

197 Demaree, R.G. DEVELOPMENT OF TRAINING EQUIPMENT PLANNING INFORMATION. Psychological Research Associates, Arlington, Virginia, 111, October 1961. (AD-267 326).

This report attempts to take proper account of both engineering and human factors considerations (with emphasis on the latter) in the determination of what items of training equipment will best serve the purposes of a particular system.

198 Dicken, C.F. SIMULATED PATTERNS ON THE CALIFORNIA PSYCHOLOGICAL INVENTORY. Journal of Counseling Psychologist, 7(1), 24-31, Spring 1960.

Five college students and two psychologist groups played roles in experiments designed to evaluate the simulability of the California Psychological Inventory. The findings were interpreted in terms of the effect of social desirability and in terms of acquiescence. For naive Ss, the CPI appears more subtle by all criteria considered than the Edwards PPS, which was investigated in a previous study.

199 Dill, William R. WHAT MANAGEMENT GAMES DO BEST. Business Horizons, 4(3), 55-64, Fall 1961.

The three common uses of management games are dicussed. When incorporated in a substantial management training program, games aimed at stimulating the players should challenge the participants, teach obvious lessons, and be simple to conduct. Games which are intended to economically provide mangement experience must simulate the complexities and uncertainties of managers' jobs. A player's behavior in a testing game may provide some indication of his future performance in a management role. At present, the greatest progress has been made in the development of games with the simplest objectives. (8 refs.)

200 Dill, William R. and Neil Doppelt. THE ACQUISITION OF EXPERIENCE IN A COMPLEX MANGEMENT GAME. Management Science, 10(1), 30-46, 1963. (Reprinted in Simulation models for education: Fourth Annual Phi Delta Kappa Symposium on Educational Research. Phi Delta Kappan, 71-103, 1965).

The study was undertaken to evaluate a complex management simulation exercise as an environment for learning. The exercise was the Carnegie Tech Management Game; the players were students in a graduate management program who played the game. Players reported learning many kinds of things from their experience, but learning derived more from interpersonal interactions with other players and with outside groups like boards of directors than from interaction with the game model itself.

201 Dill, William R., J.R. Jackson and J.W. Sweeney. PROCEEDINGS OF THE CONFERENCE ON BUSINESS GAMES. Tulane University, New Orleans, 1961.

202 Dill, William R., J.R. Jackson and J.W. Sweeney (Eds.) PROCEEDINGS OF THE CONFERENCE ON BUSINESS GAMES AS TEACHING DEVICES. Tulane University Press, 1962.

This report contains 22 individual papers on various aspects of the educational use of business games, and a summary of the informal conference discussions. A central conclusion of the conference was that management games can play an important role in helping to improve the quality of business education. However, many pertinent questions are raised concerning the effectiveness of games as opposed to other teaching techniques, the place of games in the curriculum, and the evaluation of the game experience.

203 Dill, William R., et al. EXPERIENCES WITH A COMPLEX MANAGEMENT GAME. California Management Review, 3(3), 38-51, 1961.

Games designed for teaching can also be used as diagnostic devices to spot weaknesses in the organization chart and as potent research tools into the dynamics of group behavior.

204 Doncov, B. COMPUTER TECHNOLOGY. Aerospace Technology Division, ATD Report, 66-145, Library of Congress, December, 1966.

A review of Soviet developments in computer technology. Forty-five abstracts from Soviet open-source literature are arranged alphabetically by author within each of the following categories: components, design, applications, and associated systems. An author listing is included.

205 Drenth, J.A. SIMULATION=STIMULATION, REALISM=RELEVANCE. Balance Sheet, 48, 61, 1966.

A description of a high school simulation of an actual business office operation, which has been substituted for the traditional office practice class, in order to better prepare students for positions in offices after graduation from high school.

206 Druckman, Daniel. DOGMATISM, PRE-NEGOTIATION EXPERIENCE, AND SIMULATED GROUP REPRESENTATION AS DETERMINANTS OF DYADIC BEHAVIOR IN A BARGAINING SITUATION. Dissertation Abstracts, 27(7-A), 2194-2195, 1967.

A 2x2x2 design with 15 replications in each cell was used to assess the relative contribution of personality and situational variables as determinants of conflict resolution. The task was a simulation of the collective bargaining process.

207 Dryman, I.A. THE RELATIONSHIP BETWEEN PERSONALITY AND ORIENTATION IN AN INTERPERSONAL GAME SITUATION. Dissertation Abstracts, 27(3-A), 823-824, 1966.

The study investigated the relationship between orientation (choice-expectation pattern) in a game situation and the interpersonal dimension of personality. . . Results suggested that interpersonal games may prove to be a fruitful method for the study of the relationship between interpersonal processes and personality dispositions.

208 Duffy, John O. and Major Oran B. Jolley, USA Ret. BRIEFING (TASK LIFT). Presented at 15th Annual International Air Safety Seminar, Williamsburg, Virginia, December 1962.

209 Dumas, E. ARITHMETIC GAMES. Fearon, San Francisco, California, 1960.

210 Dunlap and Associates. A METHOD FOR DERIVING JOB STANDARDS FROM SYSTEM EFFECTIVENESS CRITERIA. Volume I, Method Development. Dunlap & Associates, Santa Monica, California, Contract Number Nonr-4314(00), December 1964.

This volume describes the technical work accomplished by publication date; Volume II reports the application of the method to the AN/SPS-40 radar and is classified Confidential. As the title implies, it is an attempt to derive required standards of human performance from system parameters. Further, it is expected to yield data on the relation of personnel performance variation to system effectiveness.
After reviewing the literature, the authors conclude that none of the existing models or analytical techniques are adequate for their purpose. They then propose the Graphic State Sequence Model (GSSM) to interrelate the Personnel-Equipment Functional Units (PEF Units), and to serve as the basis for the Mathematical State Sequence Model (MSSM). This they propose to be the answer to the methodological problems.
The bibliography lists forty-nine items.

211 Dunn, P.F., C.D. Flagle and P.A. Hicks. THE QUEUIAC: AN ELECTROMECHANICAL ANALOG FOR THE SIMULATION OF WAITING-LINE PROBLEMS. Operational Research, 4, 648-662, 1956.

212 Dusenberry, J.S., O. Eckstein and G. Fromm. A SIMULATION OF THE U.S. ECONOMY IN RECESSION. Harvard University, Cambridge, Massachusetts, 1958.

213 Eckstrand, G.A. CURRENT STATUS OF THE TECHNOLOGY OF TRAINING. Aerospace Medical Research Laboratories Technical Report Number AMRL-TR-64-86, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, September 1964. 34pp. (Ad 608 216).

The report presents a brief overview of the current status of the technology of training. The process of designing a training system is divided into 3 parts and an attempt is made to summarize and evaluate the adequacy of our technology in each of these parts. In the final section promising areas of research are discussed.

214 Egbert, Robert L. THE ROLE OF COMPUTER SIMULATION IN EDUCATION. Journal of Educational Measurement, 2(1), 1-3.

Describes some of the computer simulation projects relevant to education, and how simulation patterns can be useful in education.

215 Egbert, Robert L. SIMULATION: A VEHICLE FOR FACILITATING INNOVATION AND SYSTEM DESIGN IN EDUCATION. System Development Corporation, Santa Monica, Sp 890, September 1962.

This paper discusses general problems of educational innovation and system design, simulation as a tool in education, and some restrictions on the uses of simulation. Further, goals of an initial simulation effort and of steps in the simulation process are discussed. The last part of the paper explores suggestions around the sorts of characteristics and rules which might be used in a model which would facilitate organizational design in education.

216 Elliott, Thomas K. and John D. Folley, Jr. THE MAINTENANCE TASK SIMULATOR - 1 (MTS - 1): A DEVICE FOR ELECTRONIC MAINTENANCE RESEARCH. Applied Science Associates, Inc., [illegible] Valencia, Pennsylvania, AMRL TR 64-99, October 1964.

The maintenance Task Simulator (MTS - 1) is a low priced task simulation device, specially constructed for research on performance aids used in conjunction with electronic maintenance. The device can present many complex electronic control-display panel configurations. The control-display panel is composed of a variety of modules which may contain a control or display or be blank.

217 Ely, Donald P. (Ed.) THE CHANGING ROLE OF THE AUDIO-VISUAL PROCESS IN EDUCATION: A DEFINITION AND A GLOSSARY OF TERMS. TDP Monograph Number 1. National Education Association, Washington, D.C., 1961.

218 Enke, S. ON THE ECONOMIC MANAGEMENT OF LARGE ORGANIZATIONS: A CASE STUDY IN MILITARY LOGISTICS INVOLVING LABORATORY SIMULATION. The RAND Corporation, 1368, May 8, 1958.

219 Enke, S. USE OF SIMULATION LABORATORY TO STUDY THE ORGANIZATION AND EFFECTIVENESS OF AIR FORCE LOGISTICS. (Abstract) OR JORSA, 6, 1, January-February 1958.

220 Erickson, Steve. VIVID FIRE PROBLEMS FLASHED TO HELP TRAIN FOREST FIRE FIGHTERS. Statesman, Salem, Oregon, Section 1, 6, December 19, 1965.

Description of the U.S. Forest Service fire simulator in action at the Redmond Air Center in Central Oregon.

221 Ernst, Arthur A. FEASIBILITY STUDY FOR A MAN-MACHINE SYSTEMS RESEARCH FACILITY. WADC Technical Report, 59-51. National Bureau of Standards, Washington, D.C., March 1959. (AD 213 589).

This report concerns an advanced laboratory facility for research on man-machine systems. The study postulates the possibility of employing dynamic simulation of complex weapon systems as an appropriate tool for optimization.

222 Farley, B.G. and W.A. Clark. SIMULATION OF SELF-ORGANIZING SYSTEMS BY DIGITAL COMPUTER. *IRE Trans. Information Theory*, 4, 76-84, 1954.

223 Fattu, N.A. AN INTRODUCTION TO SIMULATION. In: *Simulation models for education*: Fourth Annual Phi Delta Kappa Symposium on Educational Research. *Phi Delta Kappan*, 1-27, 1965.

224 Fattu, N.A. and S. Elam (Eds.) SIMULATION MODEL FOR EDUCATION. Fourth Annual Phi Delta Kappa Symposium on Educational Design, Bloomington, Indiana, 1965.

225 Feallock, J. Bennett and George E. Briggs. A MULTI-MACHINE SYSTEMS SIMULATION FACILITY AND RELATED RESEARCH AS INFORMATION PROCESSING AND DECISION-MAKING TASKS. *USAF AMRL*, Technical report number 63-48, 1963.

> This report describes (a) the development of Comcon, a general-purpose simulation facility for research on information processing in multiman systems; and (b) four developmental and three substantive system studies conducted on IPAC, a small-scale multiman systems simulator. Brief summaries are given for 9 studies of individual performance on information-process and decision-making tasks, and for a paper which discusses concepts and methods found to be useful in systems research. (33 refs.)

226 Feigenbaum, E.A. COMPUTER SIMULATION OF HUMAN BEHAVIOR. RAND Corporation, Santa Monica, California, P-2905, May 1964.

> This paper is a brief introduction to the computer's role as information processor and simulator. The author makes it clear that he is not dealing with analogies between computer hardware and the brain, but with simulation of human information processing.

227 Feigenbaum, E.A. AN EXPERIMENTAL COURSE IN SIMULATION OF COGNITIVE PROCESSES. *Behavioral Scientist*, 7(2), 244-245, 1962.

> A graduate seminar in this area is described, and several student reports are appended.

228 Feigenbaum, E.A. AN INFORMATION PROCESSING THEORY OF VERBAL LEARNING. The RAND Corporation, Santa Monica, 1817, October 1959.

229 Feigenbaum, E.A. THE SIMULATION OF VERBAL LEARNING BEHAVIOR. In: Proceedings of the Western Joint Computer Conference, 1961, Western Joint Computer Conference, Los Angeles, California, 1961.

An information processing model of elementary human symbolic learning is given a precise statement as a computer program, called Elementary Perceiver and Memorizer (EPAM). The program simulates the behavior of subjects in experiments involving the rote learning of nonsense syllables. A discrimination net which grows is the basis of EPAM's associative memory. Fundamental information processes include processes for discrimination, discrimination learning, memorization, association using cues, and response retrieval with cues. Many well-known phenomena of rote learning are to be found in EPAM's experimental behavior, including some rather complex forgetting phenomena. EPAM is programmed in Information Processing Language V.
This article also appears in Computers and thought, Feigenbaum and Feldman, (Eds.), p 297-309.

230 Feigenbaum, E.A. and J. Feldman (Eds.) COMPUTERS AND THOUGHT. McGraw-Hill, 1963.

Contains a collection of twenty articles on the simulation of human performance by computers. In the area of artificial intelligence, articles on game playing machines, theorem proving machines, question-answering machines, and machine pattern recognition are included. Problem solving, verbal learning, concept formation, decision making, and the simulation of social behavior are contained in section on cognitive processes. Indexed bibliography.

231 Feigenbaum, E.A. and H.A. Simon. PERFORMANCE OF A READING TASK BY AN ELEMENTARY PERCEIVING AND MEMORIZING PROGRAM. Behavioral Scientist, 8(1), 72-76, 1963.

Discusses a computer program designed to simulate the processes used by human Ss to perform rote memory tasks -- particularly learning nonsense syllables by the method of paired associates.

232 Feldman, J. SIMULATION OF BEHAVIOR IN THE BINARY CHOICE EXPERIMENT. In: Computers and Thought, E.A. Feigenbaum and J. Feldman (Eds.), 329-346. (Also in: Proc. 1961 Western Joint Computer Conference, ACM-AIEE-IRE, 133-144, 1961.

A modern, high-speed digital computer has been used to simulate the behavior of individual human subjects in a classical psychological experiment where the subject is asked to predict a series of binary events. The representation of models of human behavior in the form of computer programs has permitted the construction and study of more realistic hypothesis-testing models of behavior in this experiment rather than the over-simplified conditioning models previously proposed. A model for one subject is described in detail, and the problem of comparing the behavior of the model to the behavior of the subject is also discussed.

233 Fink, J. SIMULATION INVENTORY, N (L) - 20981/000/00. System Development Corporation, October 31, 1963.

234 Finn, J.D. A POSSIBLE MODEL FOR CONSIDERING THE USE OF MEDIA IN HIGHER EDUCATION. National Special Media Institutes, School of Education, University of Southern California, Fall 1966.

The author suggests that, for university functions, the newer educational media can be applied at several levels--as individual instructional tools, as data storage, for behavior control-type instruction, to build meaning, as research tools, as the core of instructional systems, and as a means to increase the distribution efficiency of learning experiences of all kind. If available, the individual university faculty member can select one or more of these levels at any time.

235 Finn, J.D., M.B. Boyd and D.G. Perrin. A SELECTIVE BIBLIOGRAPHY ON NEW MEDIA AND INSTRUCTIONAL TECHNOLOGY. Instructional Technology and Media Project, School of Education, University of Southern California, Los Angeles, April 1964. 54pp.

Contains 18 sections: (1) Publications of the Technological Development Project of the National Education Association (1960-1963) and Related Articles. (2)

General Audio-Visual References. (3) Audio-Visual References. (4) General Educational Implications of Instructional Technology. (5) Research Summaries and Comment. (6) Communication Theory. (7) Learning Theory and the New Media. (8) Specific Newer Technologies; a) TV, b) Language labs, c) Teaching machines and programmed instruction, d) 8mm sound film, e) Instructional systems, f) Computers in education, and g) Educational data processing. (9) General References on Computers of Interest to Educators. (10) Information Storage and Retrieval. (11) School Buildings and the New Technology. (12) Articles Critical of Instructional Technology. (13) Newer Development Leading Toward the Future. (14) Psychological Testing. (15) Professional Rights and Responsibilities of Teachers. (16) Information on General Educational Implications of Automation. (17) Bibliographies, Guides, and Indexes. (18) Further Information - Periodicals.

236 Flagle, C.D. SIMULATION TECHNIQUES. In: *Operations Research and Systems Engineering*, C.D. Flagle, *et al*. (Eds.) The Johns Hopkins Press, Baltimore, 1960.

237 Flood, M.M. GAME-LEARNING THEORY AND SOME DECISION-MAKING EXPERIMENTS; ENVIRONMENTAL NON-STATIONARITY IN A SEQUENTIAL DECISION-MAKING EXPERIMENT. In: *Decision Processes*, R.M. Thrall, C.H. Coombs and R.L. Davis (Eds.), 139-158, 287-299. Wiley, New York, 1954.

238 Flood, M.M. ON GAME LEARNING THEORY. The RAND Corporation, RM-853, 1952.

239 Flood, M.M. SOME EXPERIMENTAL GAMES. *Management Science*, 5, 1, October 1958.

240 Floody, J.J. and R.J.A. Paul. SIMULATION TECHNIQUES IN AERONAUTICS. *Journal of the Royal Aeronuatical Society*, 62, December 1958.

241 Foerster, Heinz von and Gordon Pask. PROPOSED GAME THEORETIC MODEL FOR SELF-ORGANIZING SYSTEMS. Technical Report number 5, Contract Nonr 1834 (21), University of Illinois, Urbana, Illinois.

242 Fogel, Lawrence, Alvin J. Owens and Michael J. Walsh. *ARTIFICIAL INTELLIGENCE THROUGH SIMULATED EVOLUTION.* Wiley, New York, 1966.

The authors describe a general technique which may be used to address a number of the fundamental problems of information technology including prediction, detection, discrimination, pattern classification, identification, and the control of an unknown transducer. They state that the book is intended to provide an overview of current research on the use of evolutionary programing in creating artificial intelligence.

243 Ford, L.R., Jr., H.S. Isaacson and F.C. Pethel. COMPUTER TERRAIN SIMULATION FOR LINE-OF-SIGHT CALCULATIONS. OR JORSA, 7(4), July-August 1959.

244 Forbes, John. OPERATIONAL GAMING AND DECISION SIMULATION. Journal of Educational Measurement, 2(1), 15-18, 1965.

A discussion of the advantages of using gaming models to provide dynamic training exercises for the preparation of college administrators.

245 Forland, G. and J.W. Wrightstone. AN EVALUATION OF THE AETNA DRIVOTRAINER IN SELECTED NEW YORK CITY HIGH SCHOOLS. Bulletin No. 3, New York Board of Education, Bureau of Educational Research, Division of Tests and Measurements, October 1959.

246 Foster, R.J. and J. Danielian. AN ANALYSIS OF HUMAN RELATIONS TRAINING AND ITS IMPLICATIONS FOR OVERSEAS PERFORMANCE. Technical Report 66-15, The George Washington University, Human Resources Research Office, Alexandria, Virginia, August 1966.

Evidence indicates that the nature of overseas work requires an increased emphasis on the people-related functions of job performance. The importance of these functions is further accentuated by the contrast between American and non-American values, assumptions, and perceptions, upon which effective communications and interpersonal behavior depend. Existing knowledge and experience in human relations training is reviewed in order to determine its relevance to preparing personnel for the cross-cultural aspects of overseas assignments. The training techniques of training groups (T-groups), role-playing, and case study are examined. Each is treated with respect to (1) a general description, (2) evidence as to its effectiveness,

(3) its applications in area training, and (4) possible modifications for its use in training people for overseas work.

247 Fox, Frank H. COMPUTER SIMULATION OF NEUROPHYSIOLOGICAL PROCESSES: IMPLICATIONS FOR RESEARCH IN OCCUPATIONAL THERAPY. American Journal of Occupational therapy, 20 (6), 274-279, 1966.

A brief review of some of the areas in which electronic computers have been programed to simulate neurophysioigical processes. This is suggested as a means of aiding the occupational therapist to gain greater knowledge and competence for research in this complex field.

248 Fox, J.C. and T.G. Windeknecht. SIX DEGREE-OF-FREEDOM SIMULATION OF A MANNED ORBITAL DOCKING SYSTEM. In: Proceedings of the Spring Joint Computer Conference 1963. AFIPS Conference Proceedings, 5(23), Spartan Books, 1963.

This paper describes an analog computer simulation of a manned orbital docking system conducted as a feasibility study.

249 Fraser, H.W. SIMULATION AND THE GAME APPROACH TO THE TEACHING OF ECONOMIC PRINCIPLES. Washington University, St. Louis, Unpublished paper, 1962.

250 Freed, A.M. HUMAN INTERACTIONS IN MAN-MACHINE SYSTEMS. Human Factors, 4(6), 389-396, December 1962.

"Human interactions play a vital role in the reliability of man-machine systems. Techniques are necessary to insure that those which occur do so because they are so designed and planned. A tentative approach to providing lists of such interactions, and way of defining, labelling and measuring them are suggested as basic to design input. Methods for isolating units of interactive behavior are proposed and samples of system behavior and their respective activities described in terms of actions and reactions. The need for definition and labelling of activities couched in operational terms is empahsized in the interest of design, training and measurement of human interactions in man-machine systems. Techniques for accomplishing these steps are suggested."

251 Friedman, George J. DIGITAL SIMULATION OF AN EVOLUTIONARY PROCESS. In: General Systems: Yearbook of the Society for General Systems Research, 4, 171-184, L. von Bertalanffy and A. Rapoport, (Eds.) Published by the Society, 1959.

> The theme of this paper is to investigate the possibility of finding new and perhaps more basic areas of similarity between the behavior of the living and non-living worlds, and to explore models for simulating the complex process called 'evolution'.

252 Friedman, Morris D. 8th REFERENCE BIBLIOGRAPHY, ARTIFICIAL INTELLIGNECE, SOVIET BLOC. Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts, December 27, 1961.

253 Frietag, M., A.B. Monge and L.T. Gregg. CONTROL-DISPLAY INTERFACE AND HUMAN PERFORMANCE SIMULATION. General Dynamics/Astronautics, San Diego, California, Report No. GDA-ERR-AN-524, July 6, 1964.

> This is an interim progress report covering work done from 10 February 1964 through 30 June 1964. One of its prinicipal goals was "To develop a mathematical and conceptual model of human performance for predicting operator efficiency in complex man-machine systems." This model can be described as ". . . Stimulus-response oriented, conceptualizing the human as a complex array of relays and switches whose behavior can be described by Boolean Algebra." It further assumes that the human operates ". . . as a sampled-data system that learns in an all or none manner." As behavior variation had not been programmed into the model, it was found to be useful to compare systems when non-human factors are to be varied. It was decided "to devise a more basically oriented apparatus for validating some of the primary assumptions of our performance model."

254 Frijda, Nico H. PROBLEMS OF COMPUTER SIMULATION. Behavioral Science, 12(1), 59-67, 1967.

> Computer simulation of psychological processes presents a number of problems, which are too infrequently discussed explicitly. The most important of those are the relation between a program and the theory it

embodies--it is often difficult to distinguish between the theoretically relevant aspects and those of a merely technical nature--and validation of program output. Some illustrations of the activity of detailed process simulation and some suggestions concerning validation are presented.

255 Fritz, W.B. SELECTED DEFINITIONS. Communications of the ACM, 6, 152-158, January 1963.

"Simulation -- The dynamic implementation of a model representing a physical or mathematical system and its phenomena by computers or other equipment initiating the behavior of the system in order to enable study of the system."

256 Fry, M. WAR GAMING TECHNIQUES APPLIED TO TRADE AND INDUSTRY. OR JORSA, 5, 5, October, 1957.

257 Fulkerson, D.F. and S.M. Johnson. A TACTICAL WAR GAME. OR JORSA, 5, 5, October 1957.

258 Fulmer, J.L. BUSINESS SIMULATION GAMES. Monograph C-12. South-Western Publishing Company, Chicago, November 1963.

A short general introduction followed by a computerized management decision game. An appendix illustrates the use of a non-computer game.

259 Fusca, J.A. NAVY WARFARE SIMULATOR TRAINS OFFICERS. Aviation Week, 109, 19, November 10, 1958.

260 Gagné, R.M. MILITARY TRAINING AND PRINCIPLES OF LEARNING. Presidential Address delivered at the annual meeting of the Division of Military Psychology, APA convention, New York, 1961.

General paper citing examples of how principles from the laboratory must be evaluated in terms of their applicability and usefulness in the military training setting.

261 Gagné, Robert M. (Ed.) PSYCHOLOGICAL PRINCIPLES IN SYSTEM DEVELOPMENT. Holt, Rinehart, and Winston, 1962.

A collection of 14 papers describing systematic application of psychological principles and techniques to man-machine system development.

262 Gagné, Robert M. TRAINING DEVICES AND SIMULATORS: SOME RESEARCH ISSUES. American Psychologist, 9, 95-107, 1954.

An attempt "to describe and clarify some research issues which occur in connection with the development, uses, and evaluation of training devices." An analysis of the use of training devices indicates that they have two functions: performance measurement in which the important characteristics are reliability and validity, and performance improvement in which the important characteristic is the degree of transfer of learning to the operational task. (32 refs.)

263 Gagne, R.M., *et al*. STUDIES IN FILMED INSTRUCTION: 1. INDIVIDUAL DIFFERENCES IN LEARNING FROM VISUAL AND VERBAL PRESENTATIONS. 2. THE USE OF VISUAL EXAMPLES IN REVIEW. American Institutes for Research, D73-12/65-FR, December 1965.

Studies reported in this volume concern two possible uses for visual presentations in science instruction. The first study investigated the relationships between selected individual difference variables, as measured by standard aptitude tests, and several learning indices. Spatial and verbal aptitude measures were in general not found to be differentially correlated with the learning indices of time-to-learn, achievement or retention, under different conditons of presentation. The second study used pictorial presentations in a review session following original learning of some principles of mechanical advantage. It was desired to investigate whether retention of these principles would be enhanced by review materials containing pictorial examples, and whether the inclusion of "novel" (or new) examples would increase retention and transfer. Significant differences were obtained between groups with pictorial review examples and groups with no review. No significant differences were found between groups having "old" visual examples reviewed and groups having "novel" visual examples. The author concludes that overlearning involves practice of originally learned content, rather than application to new examples.

264 Gainen, Leon. A SIMULATION MODEL FOR DATA SYSTEM ANALYSIS. In: Computers--Key to total systems control. 20, 12-14, Proceedings of the Eastern Joint Computer Conference, Washington, D.C., December 1961.

This paper discusses a generalized data system model, and describes a technique of simulating dynamic system operation with such a model in order to provide the data system designer insights on the behavior to expect from the data system as it would operate. Some of the benefits possible through such simulation are explored. The paper concludes that the major use for the present of this analytical techniques is to test the feasibility of a data system design before acquisition of actual hardware.

265 Gainen, L., R.A. Levine and W.H. McGlothin. BASELOGS-LOGISTIC MANAGEMENT GAME, RM-2086, The RAND Corporation, 1958.

266 Galliher, H.P. SIMULATION OF RANDOM PROCESSES. Notes on Operations Research 1959. The Technology Press, Cambridge, 1959.

267 Gamba, A. NEW DEVELOPMENTS IN ARTIFICIAL INTELLIGENCE AND PATTERN RECOGNITION. In: Computer and information sciences., 219-229, Spartan Books, 1964.

A report on the work done in the field of artificial intelligence at the Institute of Physics of the Universtiy of Genoa, Italy. "Intelligence must first be defined. The more 'intelligent' part of intelligence, according to my point of view (says the author), is the ability of making induction, which may be defined as follows: "from the information obtained through past experience, an inductive machine must correctly guess similar future events."

268 Gardiner, Kenneth W., et al. DIRECT FIRE SIMULATION SYSTEM. Stanford Research Institute, Menlo Park, California, October 1966.

A direct fire simulation system is shown to be essentially a communication system. Available techniques all use one or more bands within the electromagnetic spectrum. Basic techniques examined both theoretically and experimentally are the use of a microwave beam, a laser beam, and an omnidirectional infrared beacon. The infrared beacon technique is the only one capable of immediate procurement, and a system using this approach is outlined. Specific component development is recommended for the microwave beam and laser beam techniques. The direct fire simulator requirements are discussed in detail and major changes in the approach and use of DFS systems are recommended in order to make such systems feasible.

269 Garvey, Dale M. A SIMULATION OF AMERICAN GOVERNMENT. Kansas State Teachers College, Division of Social Sciences, Emporia, Kansas, November 1965.

Description of a simulation designed to help students obtain an understanding of many of the procedures and interactions which occur in the American system of government. The student is placed in a laboratory experience which permits him to perform many of the same functions that are performed by persons who perform those functions in the real world.

270 Garvey, Dale M. and William H. Seiler. A STUDY OF EFFECTIVENESS OF DIFFERENT METHODS OF TEACHING INTERNATIONAL RELATIONS TO HIGH SCHOOL STUDENTS. Final Report, Cooperative Research Project No. S-270, Kansas State Teachers College, Emporia, Kansas, February 28, 1966.

A description of a research project in which the effectiveness of simulation as an instructional technique when used in conjunction with more traditional lecture and discussion methods of instruction in the social studies is studied. A model of an internation simulation was employed, developing an understanding of (1) the interrelationships among nations, and (2) the complexity of foreign and domestic policy formulation and execution.

271 Garvey, Sancha K. A BIBLIOGRAPHY OF THE USE OF SOCIODRAMA IN THE TEACHING OF SOCIAL STUDIES. Kansas State Teachers College, Emporia, Kansas, December 1963.

A bibliography of 37 items, annotated, on Sociodrama or role playing.

272 Gaskill, R.A., J.W. Harris and A.L. McKnight. A DIGITAL ANALOG SIMULATOR. In: 1963 Spring Joint Computer Conference. AFIPS Conference Proceedings, 23, 83-90, Spartan Books, 1963.

Digital Analog Simulation (DAS) is a programming technique which makes a digital computer operate much like an analog computer. The technique was developed because it was believed that the key to easy programming is the block diagram approach normally associated with analog computation.

273 Gearon, J.D. LABOR VS. MANAGEMENT: A SIMULATION GAME. Social Education, 421-422, October 1966.

Description of classroom use of simulation activity through role playing to provide insight into labor and management relations and provide a stimulating introductory experience.

274 Gearon, J.D. WAR OR PEACE: A SIMULATION GAME. Social Education, 521-522, November 1966.

Description of an international relations game devised as a learning experience for use in ninth grade classes. Intended to provide historical insights as well as better understanding of basic terms such as foreign policy, crisis, alliance, diplomacy, treaty, and neutrality.

275 Geisler, M.A. DEVELOPMENT OF MAN-MACHINE SIMULATION TECHNIQUES. The RAND Corporation, P-1945, March 17, 1960.

276 Geisler, M.A. A FIRST EXPERIMENT IN LOGISTICS SYSTEM SIMULATION. The RAND Corporation, P-1415, July 8, 1958.

277 Geisler, M.A. INTEGRATION OF MODELLING AND SIMULATION IN ORGANIZATIONAL STUDIES. The RAND Corporation, Santa Monica, California, P-1634, March 11, 1959.

The determination of the size of a missile squadron, and the development of a suitable control and information system with the use of a man-machine simulation are described. An analytical representation shows how the relative range of parameters over which the organization appears to be efficient, is determined.

278 Geisler, M.A. MAN-MACHINE SIMULATION PROGRESS. The RAND Corporation, Santa Monica, California, P-2086, August 23, 1960.

This paper discusses a technique which has been largely developed through use in logistics research. The technique has been applied to studies of large logistics management systems in which decision-making under uncertainty is required. The procedure is to build man-machine simulations, and to use them in experimental situations. The output is a description of decision rules, information flows, and an organizational structure that improve the cost and effectiveness of the logistics system. Man is used in these simulations for his learning, adaptiveness, and flexibility.

279 Geisler, M.A. THE SIMULATION OF A LARGE-SCALE MILITARY ACTIVITY. Management Science, 5(4), 359-386, July 1959.

This paper describes the first experiment of the RAND Logistics Systems Laboratory, which was concerned with testing a series of logistics policies in a detailed man-machine simulation. The paper describes the policies, the elements simulated, the operation of the experiment, and its results.

280 Geisler, Murray A. THE SIZES OF SIMULATION SAMPLES REQUIRED TO COMPUTE CERTAIN INVENTORY CHARACTERISTICS WITH STATED PRECISION AND CONFIDENCE. The RAND Corporation, Santa Monica, California, October 1962.

The design and operation of simulation models for studying management policies and other problems that involve complex systems of random variables is presented. One of the significant statistical decisions is the size of sample to be drawn from the simulation model for making such estimates.

281 Geisler, M.A. THE USE OF MAN-MACHINE SIMULATION FOR SUPPORT PLANNING. The RAND Corporation, P-1808, September 4, 1959.

282 Geisler, M.A. THE USE OF MONTE CARLO MODELS, MAN-MACHINE SIMULATION, AND ANALYTIC METHODS FOR STUDYING LARGE HUMAN ORGANIZATIONS. The RAND Corporation, P-1634, March 11, 1959.

283 Geisler, M.A. and W.A. Steger. THE USE OF MANNED SIMULATION IN THE DESIGN OF AN OPERATIONAL CONTROL SYSTEM. Proceedings WJCC, 19, 51-62, 1961.

This paper describes the general features of the planning and operations phases of a new weapon system. The uncertainties inevitable in planning mean that considerable effort is made during the operations phase to adjust the weapon system and its resources to the actual environment it finds so as to attain the desired level of operational capability. The adjustment mechanism is called an operational control system in this paper. Elements of such an operational control system are described.
The proposal is made that a better control system can be designed if simulation is used to help design it during the planning phase. The use of simulation will not only produce a better control system earlier but it will permit the planners to adjust the other resources provided for the weapon system so that they are compatible with the environment and the control system. An example of such a study is described in this paper.

284 Gibson, J.J. (Ed.) MOTION PICTURE TESTING AND RESEARCH. Research Report No. 7, Aviation Psychology Program, Army Air Forces, Washington, D.C., 1947. (AD 651 783).

Research described resulted from effort to utilize the motion picture medium for purposes of psychological testing and examining in the Army Air Forces.

Topics included are: (1) Historical background, (2) Use of motion pictures in the design of psychological tests, (3) Technique of construction of motion picture tests, (4) Aptitude tests, (5) Proficiency tests, (6) Research on the recognition of Aircraft, (8) Pictures as substitutes for visual realities, (9) Perception and judgement of aerial space and distance as potential factors in pilot selection and training, and (10) The instructional techniques peculiar to motion pictures.

285 Giffin, S.F. THE CRISIS GAME: SIMULATING INTERNATIONAL CONFLICT. Doubleday, New York, 1965.

An account of strategy-games--logistical chess-like exercises used in the Pentagon to sharpen efficiency and prepare for eventualities. The author, a retired Brigidier General (former director of the Office of Information and Education for the Defense Department from 1957-1960), gives a history of crisis gaming and offers two main games--one based on the Cuban crisis and the second on an intricate Kashmir hypothesis.

286 Gilbert, John P. and E.A. Hammel. COMPUTER SIMULATION AND ANALYSIS OF PROBLEMS IN KINSHIP AND SOCIAL STRUCTURE. American Anthropologist, 68(1), 71-93, 1966.

A computer simulation program was set up to ask the following question: How much, and in which ways, is the rate of patrilateral parallel cousin marriage influenced by the number of populations involved in the exchange of women, by their size, by their rules of postmarital residence, and by degree of territorially endogamic preference.

287 Gilman, D.A. FEEDBACK, PROMPTING, AND OVERT CORRECTION PROCEDURES IN NONBRANCHING COMPUTER ASSISTED INSTRUCTED PROGRAMS. Journal of Educational Research, 60(9), 1967.

No differences in learning or retention were obtained for a computer assisted instruction program (CAI) which incorporated response contingent feedback, prompting, and overt correction procedures when compared to a CAI program which simply typed the correct response following a student response. No differences in learning or retention were obtained for a condition in which an instructional program was administered by a teletypewriter as compared to a condition in which the material was presented by means of programmed texts. Both conditions in which instruction was presented by a CAI communication device took significantly more instruction time than the programmed text condition.

288 Glaser, R. (Ed.) TRAINING RESEARCH AND EDUCATION. Science Editions, John Wiley & Sons, Inc., New York, 1965.

The purpose of the volume is to present a representative account of the training research that has been carried out and to examine its implications for psychological research and for training and education. The book is the offshoot of a conference held in 1960 at the University of Pittsburgh. Each chapter was written by a conference participant in an assigned area. Eighteen chapters are presented under nine headings. (1) Analysis of Instructional Objectives. (2) Individual Differences and the Design of Instruction. (3) Skill Training. (4) Simulators and Instructional Aids. (5) The Training of Technicians. (6) Proficiency Measurement. (7) Training for Multi-Man Systems. (8) New Developments in Training Research. (9) The Coordination of Research and Practice.

289 Glasser, G.J. GAME THEORY AND CUMULATIVE VOTING FOR CORPORATE DIRECTORS. Management Science, 5, 151-156, 1958.

290 Glickstein, A. and S.L. Levy. APPLICATION OF DIGITAL SIMULATION TECHNIQUES TO HIGHWAY DESIGN PROBLEMS. Proceedings WJCC, 19, 39-50, 1961.

A study of the operating characteristics of the driver-vehicle combination has yielded a general digital simulation model. This simulation model, which can duplicate traffic flow on a 17,000-ft. section of a freeway including two on-ramps and two off-ramps, can be used to economically evaluate alternate design criteria. The simulated vehicle in the model, following decision rules based on actual traffic behavior, is allowed to maneuver through the section of freeway under study. The effects of changes in traffic volume, traffic velocity. freeway configuration, etc., can then be evaluated by noting changes in the computer output of traverse time, waiting time on ramp, volume-velocity relationship, weaving complexity, etc. The computer simulation thus creates a duplication of the real situation at a small fraction of the cost of studying the real system.

291 Goldhamer, H. HUMAN FACTORS IN SYSTEMS ANALYSIS. The RAND Corporation, Santa Monica, California, Research Memorandum RM-388, (ASTIA No. ATI 78026), April 15, 1950.

The objective of this early paper was to identify aspects of systems-analysis work of interest to and significance for behavioral scientists. The deficiencies in the ways of calculating the effects of the human performance upon the entire system at that time are delineated. The need for better means of evaluating human performance as a part of systems-analysis research is well stated.

292 Goldhamer, H. and H. Speier. SOME OBSERVATIONS ON POLITICAL GAMING. World Politics, 21(1), 71-83, 1959. (First printed as P-1679-RC, The RAND Corporation, Santa Monica, California, April 30, 1959).

The political game is primarily envisaged by political scientists as a means for securing a more effective collaboration of the specialized skills involved in political-military analysis. The political game provides an easily and sharply defined division of labor for the participants, and it gives them a more systematic means of adjudicating the conflicting claims of different lines of argument. Games provide a "calculation" of consequences (anticapted and unanticipated).

293 Goldman, A., et al. USE OF THE OPERATIONAL FLIGHT TRAINER. Naval Training Device Center, Port Washington, New York, Technical Report: NAVTRADEVCEN 1734-00-1, 1966. 66pp. (AD 643 498).

Instructor activity in an operational flight trainer was studied for the purpose of improving the training capabilities of these devices. The study concerned both current utilization of the device and maximum utilization as tested by several sample problems. General results as well as specific recommendations are given.

294 Goode, H.H. SIMULATION--ITS PLACE IN SYSTEM DESIGN. Proceedings of International Radio Engineers, 39, 1951.

295 Gordon, Geoffrey. A GENERAL PURPOSE SYSTEMS SIMULATING PROGRAM. In: *Computers--Key to total systems control*, 20, 87-104, Proceedings of the Eastern Joint Computer Conference, Washington, D.C., December 12-14, 1961.

A description of the process of initiating a simulation study. The author sees two major tasks involved: (1) a model of the system to be studied must be constructed and then a program (2) that embodies the logic and action of the model must be produced. Description of the methods of describing systems is presented.

296 Gorn, S. ON THE MECHANICAL SIMULATION OF LEARNING AND HABIT-FORMING. *Information and Control*, 2(3), 226-259, 1959.

This paper discusses digital techniques by which habit-forming and learning may be simulated. After classifying the types of simulation mechanisms it discusses types of habit-forming and learning to be simulated, focusing attention upon reinforcement.

297 Grace, Gloria L. and N.A. Hofland. MULTI-MEDIA TRAINING FOR CROSS-CULTURAL INTERACTION. Professional Paper No. SP-2812. System Development Corporation, Santa Monica, California, April 1967.

Explains that the United States is engaged in stability operations on a worldwide basis. In addition to technical knowledge, cross-cultural interaction skills are required for succesful mission accomplishment. Cross-cultural experience is not readily available in the United States, but American personnel must develop cross-cultural interaction skills in order to accomplish their assigned tasks. Clearly, a practical training program is required to assist in the development of skills and attitudes necessary for successful accomplishment. Discusses the training material packages created by System Development Corporation and describes the training aids included in these packages and particularly the self-contained PACKAGE (Planned Aids for Cross-Cultural Knowledge, Action and Growth in Effectiveness). An instructor acting as a leader can train his students by following the directions and using the materials provided. He need neither concern himself with selection and preparation of subject content nor with its design or the production of training aids. His full effort can be given to guiding students through the material provided. (Author)

298 Green, B.F. COMPUTER MODELS OF COGNITIVE PROCESSES. Psychometrika, 26, 85-91, 1961.

299 Green, Bert F., Jr. INTELLIGENCE AND COMPUTER SIMULATION. Transactions of the New York Academy of Sciences, 27(1), 55-63, 1964.

Considers problems in computer simulation of intelligence. Intelligence must include verbal comprehension, fluency, perception, psychomotor coordination, number memory, and reasoning. Studies bearing on computer performance in each of these areas are cited. The role of computers in experimental tests of hypotheses about intelligence is discussed.

300 Greenberger, M. SIMULATION OF A COMPLEX ECONOMIC SYSTEM. Proceedings of the Second Operational Research International Congress. The English Universities Press Ltd., London, September 1960.

301 Greene, Jay R. BUSINESS GAMING FOR MARKETING DECISIONS. Journal of Marketing, 25(1), 21-25, 1960.

The author suggests that gaming can be used to spot weaknesses in curricula and can assume a role in testing business understanding. Simple games can become increasingly important as a first step in the development of realistic business simulation.

302 Greene, J.R. and R.L. Sisson. DYNAMIC MANAGEMENT DECISION GAMES, INCLUDING SEVEN NONCOMPUTER GAMES. Wiley, 1959.

This book was written, according to the authors, to encourage the widespread use of educational games. It contains seven noncomputer games that can be used in business-administration classes or executive-development programs. They can also be played at home by persons who wish to improve their understanding of gaming. The games presented cover every level of management in a business organization, and include dozens of different business problems. The games in this book are referred to as Dynamic Management Decision Games to distinguish them from business case studies and from games created principally for entertainment purposes.

303 Greene, R.M., Jr. REPRESENTATION OF HUMAN FUNCTIONS IN BUSINESS SYSTEM SIMULATIONS. FN 3745, System Development Corporation, Santa Monica, June 1960.

This paper reports plans and progress toward formulation of a digital computer program which will provide simulation of human functions for use in large-scale business system simulation. The proposed program includes stochastic elements and provides for the insertion of research findings about human variability and the effects of it upon information flow. Illustrative flow charts are included.

304 Greenlaw, P.S., L.W. Herron and R.H. Rawdon. BUSINESS SIMULATION IN INDUSTRIAL AND UNIVERSITY EDUCATION. Prentice-Hall, 1962.

This book provides helpful guidance and a comprehensive source of information on the design, administration, and educational uses of business simulations, both in university curricula and in the management training programs of industry. It is suggested that business games have a promising future in education and that they will take their place as one more highly effective tool of the teaching profession.

305 Gregg, L.T.. MAN-MACHINE SYSTEM STUDIES. General Dynamics/Astronautics, San Diego, California, Report No. GDA-DBB64-038, December 15, 1964.

"This report is a summary of applied research performed during 1964 (in the field of) . . . Environmental Analysis of Man-Machine Systems. . . . A mathematical model of operator performance has been developed for use in digital computer simulation of complex man-machine systems. The model . . . is currently being validated by comparison of model predictions with psychophysical data gathered from laboratory experiments.

The mathematical model is expressed in Boolean algebra, . . . relationships between machine variables and operator variables are thus uniquely expressed by symbolic logic operators. . . . apparatus has been constructed and used to gather the empirical data for model verification . . . Exploratory studies have shown that computer simulation is an efficient and valuable method for validating man-machine task analyses . . . using selected portions of the mathematical model of operator performance."

306 Gruenberger, F. BENCHMARKS IN ARTIFICIAL INTELLIGENCE. Datamation, October 1962.

307 Gruenewald, Doris and Erika Fromm. HYPNOSIS, SIMULATION, AND BRAIN DAMAGE. Journal of Abnormal Psychology, 72(2), 191-192, 1967.

Reports a design using indirect hypnotic suggestion on normal Ss to bring out behavior and psychological test patterns commonly found in brain-damaged persons.

308 Gryde, Stanley K. FIDELITY OF SIMULATION AND TRAINING EFFECTIVENESS. University of Southern California, Los Angeles, 256436/1105, NROS, 11-1.

A discussion of the dilemma posed by Muckler regarding fidelity of simulation; to solve it, a formal statement about fidelity should be developed. It may require that the research be very limited in number and topics. It may be that the procedural trainers will offer the best area in which to apply these theories of transfer. Muckler's opinion, according to Gryde, is that until this is done, few rational decisions will be made concerning the utilization and design of (flight) simulators. "For this reason, the field of simulation continues to be the happy playgound of the engineer in which he provides the most sophisticated engineering fidelity the state-of-the-art can provide."

309 Guetzkow, Harold (Ed.) SIMULATION IN SOCIAL SCIENCE: READINGS. Prentice-Hall, 1962.

This volume provides source material on the use of man, man-computer, and all-computer simulation which will acquaint students and lay people with the recent and expanding use of simulation as a technique for experimentation and teaching in the behavioral sciences.

310 Guetzkow, H. A USE OF SIMULATION IN THE STUDY OF INTER-NATION RELATIONS. Behavioral Science, 4, 183-191, 1959.

Following the model of simulated war games and military-political exercises, the author develops a simulated model for internation relations--alliances, international parleys, governmental conferences, and internal decisions--and the use of this technique for theory development and training. (19 refs.)

311 Guetzkow, H. TRAINING FOR POLICY-MAKING ROLES THROUGH ORGANIZATIONAL SIMULATION. Proceedings, 14th Annual Conference, American Society of Training Directors, 76-79(b), May 1958.

312 Guetzkow, H., et al. SIMULATION IN INTERNATIONAL RELATIONS: DEVELOPMENTS FOR RESEARCH AND TEACHING. Prentice-Hall, 1963.

The simulation of international political-economic systems through the use of man-computer approach is described. The 5 co-authors were involved in the development and/or early application of computer techniques in the simulation of problems in international relations. Presented are a general overview of the use of simulation techniques in the study of international problems; the evolution and development of the internation simulation game at Northwestern; the application of internation simulation in the teaching of political science; descriptions of actual problems; and summaries of participants reactions, specimen work sheets, protocols and other displays.

313 Gullahorn, John T. and Jeanne E. Gullahorn. A COMPUTER MODEL OF ELEMENTARY SOCIAL BEHAVIOR. System Development Corporation, Santa Monica, California, March 27, 1962. (Reprinted, Behavioral Science, 8, 354-362, 1963).

Complex social behavior is reduced to symbol-manipulating processes on a digital computer by means of the IPL - V (Information Processing Language - Versus V). Unlike the cognitive models of Feigenbaum and Feldman, Homonculus, as this model is called, focuses on individual decision-making in social interactions using rewards and punishments. It is like the Feigenbaum and Feldman models in that Homonculus emphasizes non-numerical processes and is essentially deterministic rather than probabilistic. The theory used as a model for this program is from George Homans' Social Behavior.

314 Gullahorn, J. and J. Gullahorn. HOMUNCULUS: A SIMULATION OF SOCIAL INTERACTION. Michigan State University, East Lansing, Michigan, 1962.

315 Gulliksen, Harold. MATHEMATICAL SOLUTIONS FOR PSYCHOLOGICAL PROBLEMS. Selected bibliography on mathematical models related to psychology. Office of Naval Research, Technical Report, National Science Foundation Grant G - 642, 45-54, June 1958.

316 Gumbrell, Arthur J. SIMULATION AS A TEACHING TOOL. California Teachers Association Journal, 63, 11-13, 1967.

Students develop their own games, when encouraged; this paper describes the use of simulation as a teaching tool in secondary schools, giving examples (such as the development of language-logic and a logic course for sound-slide presentation) of the kinds of simulations students can prepare for themselves.

317 Guss, Carolyn. ROLE-PLAYING SIMULATION IN INSTRUCTION. AV Instruction, 11, 443-444, 1966.

A report of Project SIMILE on using simulation to teach international relations. Project directors suggest that the payoff for role playing is a wholesome change of classroom climate in which students drop their artificial facades and meet teachers in more authentic relationships. In a role-playing atmosphere students develop empathy with real-life decision makers, appreciation of the complexity of the world, and understanding of personal interrelationships and communication processes.

318 Gyr, John, James Thatcher and George Allen. COMPUTER SIMULATION OF A MODEL OF COGNITIVE ORGANIZATION. Behavioral Science, 7(1), 111-116, 1962.

Describes the properties of the computer program written to fit a model of cognitive organization derived from an earlier study of problem solving and information processing. Discusses the problems of the earlier research and the empirical properties of the derived model.

319 Gyr, J.W., et al. COMPUTER SIMULATION AND PSYCHOLOGICAL THEORIES OF PERCEPTION. Psychological Bulletin, 65(3), 174-192, 1966.

Computer simulations of perceptual processes have often not related directly to questions of concern to the psychology of perception and, in particular, have regarded perception as a sensory, as opposed to a sensorimotor or active, process. Some of the psychological literature which is relevant to the issue of perception as a passive vs. an active process is reviewed and differences between these alternative conceptions of perception and gains to be derived from using the active-perceiver model are spelled out. Past computer models are reviewed in the light of such theories. A different simulation program based explicitly on the active-perceiver model of perception is then sketched in broad outlines and its potential for doing research upon psychological problems is reviewed. (50 ref.)

320 Gyr, John W. et al. COMPUTER SIMULATION OF PERCEPTUAL DEVELOPMENT. Perceptual and Motor Skills, 23(3, Pt. 1), 793-794, 1966.

A part of the second phase of a project on perception which permits study of additional simulated problems is described.

321 Haggard, D.F. TRAINING METHODS FOR SIMULATORS OF REMOTE CONTROL HUMAN-GUIDED MISSILE SYSTEMS: 1. A COMPARATIVE EVALUATION OF COMPONENT SKILL AND TOTAL SKILL TRAINING EXERCISES. Research Memorandum, July 1962.

Seven training programs including total task practice and component skill groups were compared to determine relative effectiveness for simulator training (Particularly S-55 simulator). Total task practice was superior to the others. It was concluded that the S-55 is not so complex as to require training fractionation.

322 Halbert, Peter W. HYBRID SIMULATION OF AN AIRCRAFT ADAPTIVE CONTROL SYSTEM. AFIPS Conference Proceedings, 5(23), 1963. Spring Joint Computer Conference. Spartan Books, 1963.

Prediction of future aircraft performance can be accomplished via high-speed integration of the model equations; the feasibility of using a predictive technique of this sort is to be determined by means of a hybrid simulation.

323 Halbert, S.F. WRONG-WAY DRIVER: OFF-RAMP STUDIES. Institute of Transport and Traffic Engineering Spec. Rep., 1963.

Studies on a driver simulator compared white and black and white and red "Do not enter" signs. Earlier and more correct responses were made to the red and white signs. Modification of the standard arrow by extension and narrowing of the stem and creating a "sweptback" arrow head improved legibility of the arrows.

324 Haldi, John and Harvey M. Wagner. SIMULATED ECONOMIC MODELS. Richard D. Irwin, Inc., Homewood, Illinois, 1963.

This book reports on an innovation in teaching modern microeconomic theory. It is written for liberal arts, business, and engineering students who are learning economic principles. In a series of controlled laboratory experiments students demonstrate the scientific validity of current economic theory of market behavior by enacting managerial business decisions. This method of teaching can demonstrate

(1) how economic theory can be applied in a variety of realistic and complex situations, (2) how a free enterprise system functions to determine what shall be produced, how, and for whom, (3) how dynamic forces guide a competitive market economy toward equilibrium, and (4) how factors of uncertainty and risk must be taken into account when making ecomonic decisions.

325 Hammerton, M. MEASURES FOR THE EFFICIENCY OF SIMULATORS AS TRAINING DEVICES. Ergonomics, 10(1), 63-65, 1967.

The difficulties of selecting suitable measures for the efficiency of simulator training devices are discussed, and some of the pitfalls are pointed out. Several formulae are discussed in the light of what a potential user would wish to know; and some are recommended for use.

326 Hammerton, M. TRANSFER OF TRAINING FROM A SIMULATED TO A REAL CONTROL SITUATION. Journal of Experimental Psychology, 66, 450-453, 1963.

This reports an examination of transfer of training when tasks differed only in display appearance; angular control/display relationships were identical. An experimental group of 11 unskilled Ss were trained on a CRT to control the movements of a trolley moving along a miniature railway; a control group of 12 Ss practiced on the real trolley ab initio. Initial transfer was poor (-17% by one measure); the performance decrement being pronounced ($p<.1\%$). Saving, however, was considerable (>.70%). Conclusions are: (a) motor response is not immediately transferred, despite identical dynamics and display kinematics, (b) recovery of skill is very rapid, (c) these findings may be attributed to stimulus compounding.

327 Hammerton, M. and A.H. Tickner. VISUAL FACTORS AFFECTING TRANSFER OF TRAINING FROM A SIMULATED TO A REAL CONTROL SITUATION. Journal of Applied Psychology, 51(1), 46-49, 1967.

If the requirement of a simulator is that it should save training time, a relatively simple visual display can be quite sufficient. The desirability of good initial transfer must be weighed against the increasing cost of realistic simulation.

328 Hare, A. Paul. COMPUTER SIMULATION OF INTERACTION IN SMALL GROUPS. Behavioral Science, 6(3), 261-265, 1961.

The goal of naturalistic prediction of behavior in small groups may only be possible through the use of computer simulation. This paper describes the "Interaction Simulator" being developed at Harvard University.

329 Hare, Van Court, Jr. SYSTEMS ANALYSIS. In: Progress in Operations Research, 2(5), 144-147, 4.1 Simulation methods. David B. Hertz and Roger T. Eddison, (Eds.), 1964.

The section on simulation methods, (above) in this chapter examines basic problems which the systems analyst must consider before attempting to use simulation techniques; viz., caution must be exercised not to carry too much detail in the simulation study so that the simulation proves too costly, test cases take too long to compute, or the simulation project gets out of hand because its logic of operation is not well understood. "Moreover, the analyst cannot, by simulation, evade the basic requirement of developing critical tests and selecting relevant choices for system modification."

330 Harling, John. SIMULATION TECHNIQUES IN OPERATIONS RESEARCH - A REVIEW. Operations Research, 6, 307-319, 1958.

"The purpose of this paper is to give an introductory account of the techniques of simulation, to present a few of the leading ideas which have been developed, and to draw attention to what is in fact a very open and somewhat ill-defined subject."

331 Harman, Harry H. SIMULATION: A SURVEY. In: Proceedings of the Western Joint Computer Conference, 1961. Western Joint Computer Conference, Los Angeles, California, 1-9, 1961. (First printed as System Development Corporation paper, Report No. SP 260, July 1961).

Current work in simulation is appraised and definitions of the word simulation are reviewed. While the Monte Carlo Method represents a very powerful and useful technique in simulating it does not encompass all the legitimate scientific aspects of simulation. The selection of appropriate elements of a system to be simulated and the classification of simulation types remain continuous problems in the field of simulation. The advantages of simulation as a research tool are discussed, and simulation activities are reviewed.

332 Harman, Harry H. THE SYSTEMS SIMULATION RESEARCH LABORATORY. Technical Memorandum (TM series), TM-498. System Development Corporation, Santa Monica, April 1960.

A description of the establishment of the SSRL at SDC in 1960. ". . .to study such systems in the Laboratory it will be necessary to simulate certain portions. We will have to simulate the real system by what we call functional simulation--such functional simulation might be started in terms of two broad classes: the formal or symbolic or mathematical simulation, and the material or facsimile simulation, i.e., the replication of parts of the system . . . We would use simulation most effectively in representing deterministic models of control systems for the study of man-machine dynamics and also in dealing with probablistic or stochastic models of systems for operations analysis and evaluation. . ."

333 Harrison, Joseph O., Jr. and Mary Frances Barrett. COMPUTER-AIDED INFORMATION SYSTEMS FOR GAMING. Research Analysis Corporation, McLean, Virginia, September 1964.

Scientific war games have been under development by military operations research groups since about 1960 and business games by industrial operations research groups since 1956. From an information system point of view these games may be divided into three types--computer simulations, digital man-machine games, and continuous variable man-machine games. Computer simulations, or completely automated games, (i.e., Carmonette) are always rigid, usually stochastic, and generally very detailed. Since they are not limited by the decision-making speed of human beings, they may be executed rapidly, permitting repeated plays with large-scale variations of input conditions and chance factors. Digital man-machine games, or partly mechanized games, (i.e., Theaterspiel) employ digital computers for bookkeeping, computing, and transmission of data but use people for decision making. In digital man-machine games both speed of execution and level of detail are sacrificed in the interests of obtaining the flexibility of human participation. Continuous variable man-machine games employ people for decision making and electronic analog computers for computation. The human decisions are introduced continuously as the game proceeds rather than periodically.

334 Harsanyi, John C. APPROACHES TO THE BARGAINING PROBLEM BEFORE AND AFTER THE THEORY OF GAMES: A CRITICAL DISCUSSION OF ZEUTHEN'S, HICKS' AND NASH'S THEORIES. Econometrica, 24, 144-157, 1956.

A theoretical discussion of the problems involved in bargaining theory. It is stipulated that finding a satisfactory determinate solution for the general n-person game will do much more than make a general theory of oligopoly possible, it will open the way for a general theory of the distribution of income and of power within society.

335 Harsanyi, John C. A BARGAINING MODEL FOR SOCIAL STATUS IN INFORMAL GROUPS AND FORMAL ORGANIZATION. Behavioral Science, 11(5), 357-369, 1966.

Among all noneconomic motivational variables, social status may be the most important one. But social status itself is too complex a social phenomenon to be used as a further-not-analyzed primitive concept of the theory. An attempt is made to analyze social status in terms of some more basic human motivations, by asking the questions why people seek high social status and why some people are granted high social status by others, and to answer these questions in terms of a game-theoretical bargaining model for social status.

336 Harsanyi, John C. A BARGAINING MODEL FOR THE COOPERATIVE N-PERSON GAME. In: Contributions to the theory of games, v. IV, A.W. Tucker and R.D. Luce, (Eds.) Princeton University Press, 1959.

A theory of n-person game that yields a determinate solution can make important contributions to the analysis of a number of economic, political and other social phenomena, such as oligopoly with more than two oligopolists; many concerned bargaining situations (e.g., bargaining on the labor market among several employer and employee organizations and possibly even government agencies); the distribution of income and power in a given social organization or in a whole society; the distribution of territory and spheres of influence among several countries in international politics; and in general the balance of power among several individuals or social groups.

337 Harsanyi, John C. MEASUREMENT OF SOCIAL POWER IN _N_-PERSON RECIPROCAL POWER SITUATIONS. _Behavioral Science_, 7(1), 81-91, 1962.

This paper tries to extend the concepts of amount of power and strength of power to _n_-person reciprocal power situations, where all _n_ participants have some power over one another and over the joint policies of their group. Intuitively, the amount of a person's power is a mesure of the probability of his being able to achieve adoption of joint policies agreeing with his own preferences; while the strength of his power is a measure of the strength of the incentives he can provide for the other participants to agree to his policy proposals, and more generally, the strength of his bargaining position against the other participants. To define the strength of power the paper uses the author's bargaining model for the _n_-person game. The measure obtained in this way can be regarded as a generalization of the power measure of Shapley and Shubik.

338 Harsanyi, J.C. MEASUREMENT OF SOCIAL POWER, OPPORTUNITY COSTS, AND THE THEORY OF TWO-PERSON BARGAINING GAMES. _Behavioral Science_ , 7(1), 67-80, 1962.

Several authors have recently suggested measuring social power in terms of its effects; that is, in terms of the changes that A can cause in B's behavior. This paper argues that an adequate measure of power must also contain information on the two parties' opportunity costs--the costs to A of acquiring or using his power over B, which the paper calls the costs of A's power; and the costs to B of noncompliance, which measure the strength of B's incentives to compliance and which the paper calls the strength of A's power over B. For bilateral power situations where both partners can exert pressure on the other, a somewhat different game-theoretical measure for the strength of A's power is developed.

339 Harsanyi, John C. ON THE RATIONALITY POSTULATES UNDERLYING THE THEORY OF COOPERATIVE GAMES. *Journal of Conflict Resolution*, 5, 179-196, 1961.

The purpose of this paper is to re-state and re-examine the rationality postulates underlying the theory of cooperative games. It is also proposed to discuss T.C. Schelling's recent criticism of some game-theoretical postualtes, in particular the symmetry postualte (see Schelling, The strategy of conflict: Prospectus for the reorientation of game theory. *Journal of Conflict Resolution*, 2, 203-264, 1958).

340 Harsanyi, John C. A SIMPLIFIED BARGAINING MODEL FOR THE *N*-PERSON COOPERATIVE GAME. hectographed, 1960. (Available from author on request).

341 Harsch, O. Henry and Herbert Zimmer. AN EXPERIMENTAL APPROXIMATION OF THOUGHT REFORM. *Journal of Consulting Psychology*, 29(5), 475-479, 1965.

Thought reform processes were simulated in the laboratory with 96 Ss. The Ss were required to evolve an extended series of alternative responses from their own behavior repertoire, in successive approximation to the criterion demanded by the E, which remained unknown to the Ss. This study sought to achieve the abandonment of a basic behavior pattern and the adoption of a new behavior pattern of more than momentary duration. The experimentally induced changes of the Ss, in the direction opposite to their starting positions, persisted over an 8-day follow-up period. Sex and the use of positive or negative signals had no effect on the magnitude of the changes.

342 Hartman, John J. *ANNOTATED BIBLIOGRAPHY ON SIMULATION IN THE SOCIAL SCIENCES*. Iowa State University, Agricultural and Home Economics Experimental Station, Ames, 1966.

An annotated bibliography which lists articles, books, and bulletins of interest to behavioral scientists who are planning simulation studies as a method of analysis has been prepared by Iowa State University. In addition to publications concerned with simulation in the disciplines of communications, medical sociology, political science, psychology, social psychology, sociology and geography, articles dealing with a general consideration of the assumptions used in the philosophy of computer simulation have been included. Articles have been classified as to whether they deal with (1) the assumptions and philosophy of computer analysis, (2) the methodological aspects of computer simulation, or (3) reporting results of studies without much emphasis of methodology. The report also contains definitions of the basic terms used in the bibliography. (74 refs.)

343 Hauser, Norbert, Norman N. Barish and Sylvain Ehrenfeld. DESIGN PROBLEMS IN A PROCESS CONTROL SIMULATION. Journal of Industrial Engineering, 17(2), 79-86, February 1966.

A discussion is given of various procedures which are used to evaluate the efficiency and stopping rules for deciding on the length a simulation is run in order to obtain a desired confidence level. Basically, two methods were used for these evaluations; the serial correlation approach and the subgrouping approach. In the author's experiments, the subgrouping method turned out to be superior. (18 refs.)

344 Hayes, R.B. IMMEDIATE LEARNING REINFORCEMENT. AV Communication Review, 377-381.

A study designed to determine the effectiveness of immediate reinforcement in learning a complex mental-motor skill. Twelve simulated automobiles were used to study the effects of immediate feedback of error in speed, steering, braking, or turn-signals.

345 Haythorn, William W. GROUP COMPOSITION IN AN ISOLATION ENVIRONMENT. Proceedings of the 4th IBM Medical Symposium, 151-161, October 1962.

Plans are described for programming a computer simulation of some effects of isolation and confinement on the performance and adaptation of groups of men. Using a simulation of personality interactions, the computer model allows the investigator to determine quickly the implications of group composition of particular pieces of personality information derived from empirical research and to permit extrapolation from the available research data to situtations that have been examined empirically.

346 Haythorn, W.W. HUMAN FACTORS IN SYSTEMS RESEARCH. The RAND Corporation, Logistics Department, Santa Monica, California, June 7, 1961.

Points up the need for Human Factors Research and the need to use it properly.
Reminds us that the "human factor" can improve and facilitate the system as well as degrade it.
Emphasizes the need for a holistic approach to system development research, and describes how simulation models can be of particular assistance, if they are formulated realistically.

347 Haythorn, William W. INFORMATION SYSTEMS SIMULATION AND MODELING. 1st Congress Information System Sciences, Bedford, Massachusetts, Session 7, 89-100, November 1962.

This is a general discussion of some results from information systems experiments using teams of human decision-makers, which RAND has conducted. The main conclusions are concerned with the methodology of large game exercises, and considerable stress is placed on defining and controlling parameters. This is supported by interesting examples, but their complexity precludes a detailed description in the paper. They show that proper design can yield scientifically meaningful results, but still the experimenter must interpret the methodology of game exercises in each particular case. Finally, the author turns the method on himself and proposes a check-list of research functions for those engaged in systems research projects. This may be useful in its way, but tends to confuse the systematic scientific method with the production programming of research; this latter is one of the frightening symptoms of military sponsorship.

H.C. Ratz, Saskatoon, Canada

348 Haythorn, W.W. SIMULATION IN RAND'S LOGISTICS SYSTEMS LABORATORY: LABORATORY PROBLEM I. The RAND Corporation, P-1456, September 3, 1958.

349 Haythorn, W.W. SIMULATION IN RAND'S LOGISTICS SYSTEM LABORATORY. Report of System Simulation Symposium, D.G. Malcolm, (Ed.). Waverly Press, Baltimore, 1957.

350 Hemphill, J.K., D.E. Griffiths and N. Frederiksen. ADMINISTRATIVE PERFORMANCE AND PERSONALITY: A STUDY OF THE PRINCIPAL IN A SIMULATED ELEMENTARY SCHOOL. Bureau of Publications, Teachers College, Columbia University, New York, 1962.

A report of a study in which a standard administrative situation was constructed by means of which administrative behavior could be elicited and observed or recorded. Important tasks from the job of the elementary school administrator were simulated and condensed within the period of one week. The results indicated that simulation, as used in this study, can be useful for analyzing performance variables and personality tendencies pertinent to school adminstration.

351 Hermann, C.F. and M.G. Hermann. ON THE POSSIBLE USE OF HISTORICAL DATA FOR VALIDATION STUDY ON THE INTER-NATION SIMULATION. Naval Ordnance Test Station, China Lake, California, Mimeographed paper, 1962. 37pp.

352 Herron, Lowell W. EXECUTIVE ACTION SIMULATION. Prentice-Hall, 1960.

"Executive action simulation" is the name of a business game designed to be highly competitive, and to be played by management teams. It affords participants the chance to make decisions in a realistic atmosphere following a set of rules which resemble the economics of business.
Instructions for participants, and umpire (teacher or administrator), are given in detail.

353 Hershey, Gerald L., Loraine V. Shepard and John D. Krumboltz. EFFECTIVENESS OF CLASSROOM OBSERVATION AND SIMULATED TEACHING IN AN INTRODUCTORY EDUCATIONAL PSYCHOLOGY COURSE. The Journal of Educational Research, 58(5), 233-236, 1965.

The purpose of this study was to compare experimentally two methods of teaching the relationship of psychological knowledge to instructional practices: (1) off-campus trips for public school classroom observations; (2) on-campus simulated teaching experiences. Results yielded the fact that subjective ratings revealed that students felt that the classroom observation had had more general benefit on their development as teachers although the simulated teaching experience was rated more helpful in mastering certain teaching skills.

354 Heyne, Jay B. MANAGEMENT CONTROL THROUGH TOTAL SIMULATION. SP-171, System Development Corporation, June 1960.

Purpose of the study was to develop criteria which would enable the design of total management control systems. It was felt to be conceivable that a general system simulation language might be a byproduct of this endeavor. Encompassed in the endeavor was the establishment of criteria related to the introduction of data-processing equipment into management control systems.

355 Hickok, W.H. A BIBLIOGRAPHY OF RESEARCH STUDIES ON GAMES AND SIMULATIONS. Northwest Regional Education Laboratory, Portland, Oregon, March 1967.

Ninety-eight references on educational games and simulations resulting from the Clark County (Washington) Workshop on Instructional Games held March 1967.

356 Hilgert, R.L. ARBITRATION CASE SIMULATION: A UNIVERSITY CLASSROOM EXPERIENCE. Journal of Business Education, 157-158, January 1965.

A description of a simulation in a classroom setting in which students took the parts of Union witnesses, management witnesses, and the Arbitration board. The author concludes that the technique has high motivational value.

357 Hill, J., G. McMurtry and K. Fu. A COMPUTER-SIMULATED ON-LINE EXPERIMENT IN LEARNING CONTROL SYSTEMS. AFIPS Conference Proceedings, 5(25). Spring Joint Computer Conference, 1964, Spartan Books, 1964. (Also reprinted in Simulation, 4, 117-126, 1965).

The recently developed concept of learning control systems is presented, and the discussion is illustrated with the simulation of a typical problem implemented on a hybrid computer.

358 Hoagbin, J.E. and J.M. Miller. AN APPROACH TO PREDICTING PERFORMANCE OF MAN-MACHINE SYSTEMS. Symposium on Prediction of Performance of Large-Scale Systems. University of Michigan, Willow Run Laboratories, Ann Arbor, Report No. 2354-11-8, January 1959.

359 Hoffman, A.J. and M. Richardson. BLOCK DESIGN GAMES. Canadian Journal of Mathematics, 13,110-128, 1961.

In this paper, the study of an extensive family of simple n-person games based in a natural way on block designs (and hitherto for the most part unexplored except for the finite projective games), is defined and begun.

360 Hoggatt, A., (Ed.) PROCEEDINGS OF WESTERN MANAGEMENT SCIENCE CONFERENCE ON SIMULATION. 1962.

361 Hoggatt, Austin C. MEASURING THE COOPERATIVENESS OF BEHAVIOR IN QUANTITY VARIATION DUOPOLY GAMES. Behavioral Science, 12(2), 109-121, 1967.

An economic game (Cournot quantity variation duopoly) was employed to create a laboratory market environment in which there were elements of cooperation and competition. The game is described in detail.

362 Hoggatt, Austin C. AN EXPERIMENTAL BUSINESS GAME. Behavioral Science, 4(3), 192-203, 1959.

Most of us have played Monopoly for amusement, but now industry is beginning to take similar games seriously as training situations for management personnel. Groups of executives are sent to "retreats" to play business games to learn what is involved in making decisions. Here is an example of a business game used as a research tool for the study of human behavior in conflict situations.

363 Hoggatt, A.C. A SIMULATION STUDY OF AN ECONOMIC MODEL. Contributions to Scientific Research in Management. Los Angeles, California: The Proceedings of the Scientific Program following the Dedication of the Western Data Processing Center, Graduate School of Business Adminstration, University of California, January 29-30, 1959.

364 Hoggatt, A.C. and F.E. Balderston. MODELS FOR SIMULATION OF AN INTERMEDIATE MARKET. University of California, Berkeley, processed, June 24, 1958.

365 Hoggatt, E.C. SYMPOSIUM ON SIMULATION MODELS; METHODOLOGY AND APPLICATIONS TO THE BEHAVIORAL SCIENCES. Conference on Computer Simulation, U.C.L.A., 1961. E.C. Hoggatt and F.E. Balderston, (Ed.). South-Western Publishing Company, Cincinnati, 1963.

366 Holland, Edward P. SIMULATION OF AN ECONOMY WITH DEVELOPMENT AND TRADE PROBLEMS. *American Economic Review*, 52(3), 408-430, 1962.

> The purpose of this article is to illustrate how the techniques of simulation can be used to study problems of economic development and foreign trade policy for an underdeveloped country.

367 Holland, E.P. PRINCIPLES OF SIMULATION. In: Organization, planning, and programming for economic development, 8, *Science, Technology, and Development*, U.S. Government Printing Office, Washington, D.C., 106-118, 1962.

> This paper was one of those prepared to represent the United States in the United Nations Conference on the Application of Science and Technology for the benefit of the less developed areas. Simulation as a technique for simulating an economic system and for designing development policy is offered as a way of applying science and technology to benefit less developed areas.

368 Holland, E.P. with R.W. Gillespie. EXPERIMENTS ON A SIMULATED UNDERDEVELOPED ECONOMY: DEVELOPMENT PLANS AND BALANCE-OF-PAYMENTS POLICIES. MIT Press, 1963.

> Simulation applied to economic analysis. As used in this study, simulation means using a computing machine to work out the evolution of variables in a

specified dynamic system under given conditions. Useful for studying mutually interacting processes which involve nonlinearities and time lags. A report on exploratory experiments in economic dynamics performed on a simulated underdeveloped economy.

369 Holland, Edward P., B. Tencer and R.W. Gillespie. A MODEL FOR SIMULATING DYNAMIC PROBLEMS OF ECONOMIC DEVELOPMENT. MIT Center for International Studies, Cambridge, Massachusetts, Report c/60-10, 1960.

370 Holmes, M.G. APPLICATION OF SIMULATION IN COMMAND AND CONTROL SYSTEMS. Sp-1455, 5, November 1963.

371 Holstein, W.K. and W.R. Soukup. MONTE CARLO SIMULATION. Institute Paper No. 23, Institute for Quantitative Research and Economics and Management, Graduate School of Industrial Administration. Purdue University, Lafayette, Indiana, 1, 1962.

372 Holtby, Bert. FROM THE BLACKBOARD TO THE SIMULATOR. Talk given May 10, 1963, at the annual meeting of the Southern California Association of Foresters and Fire Wardens. 10pp.

A brief account of how the Forestry Service began to use simulation techniques; a description of the simulator used by the Forestry Service. Description of debriefing, pages 7 and 8.

373 Hood, P.D. THE APPRENTICE LEADER-PREPARATION FOR A ROLE. Paper presented to the 1966 APA Convention. HumRRO Division No. 3, June 1966. (Draft professional paper).

A description of a preparation (training) program to train potential leaders for major combat and major combat support specialties. This paper describes how the program was designed and how important research was in developing it.

374 Hormann, Aiko M. DESIGNING A MACHINE PARTNER. Datamation Magazine, 29-33, February 1967. (AD 651 494).

A general discussion of the prospects and problems of designing "adaptive" machines. Discussed are the requirements for an adaptive machine, the problem domains in which this type of machine may be useful, and the methods and approaches being used to approach some of the problem areas.

375 Horvat, John J. FEEDBACK IN THE NEGOTIATIONS GAME. A paper presented at the AERA Symposium: Feedback in Simulation Techniques, February 18, 1967.

A description of the "Negotiation Game", which is an instructional device which attempts to simulate some of the conditions encountered within professional negotiations, or professional bargaining, sessions in educational contexts.

376 Horvath, William J. THE SYSTEMS APPROACH TO THE NATIONAL HEALTH PROBLEM. Management Science, 12(10), B-391-395, June 1966.

Modern-day medicine has become a highly complex system with numerous problems. To deal with these problems the medical profession will have to draw on the resources of systems analysis. The use of gaming and simulation procedures is proposed as a first step. (1 ref.)

377 Houston, University of. Center for Research in Business and Economics, College of Business Administration. MANTRAP: MANAGEMENT TRAINING PROGRAM. THE PLAYER'S MANUAL, 1, Pt. 1. University of Houston Press, 1963.

Mantrap is a business game designed to simulate conditions in the small business firm within which management must make major policy decisions. Through playing the game, an individual should develop an insight into the type of problems facing the small firm and also into the most effective strategy that can be used in dealing with these problems.

378 Hovland, Carl I. COMPUTER SIMULATION IN THE BEHAVIORAL SCIENCES. In: The behavioral sciences today, 77-88, Bernard Berelson, (Ed.) Harper, 1963.

A review of the role of computer machines in simulating learning, i.e., stimulus-response, patterns embedded in complex stimuli, etc. These new techniques are useful in sharpening our formulations concerning mental processes and phenomena and place emphasis on developing theories which have both descriptive and predictive power. Two difficulties involved are the complexity of the process to be simulated and the nature of the process with which we are concerned, i.e., the computer works only when a single stage is involved.

379 Hovland, Carl I. COMPUTER SIMULATION OF THINKING. American Psychologist, 15, 687-693, 1960. (Reprinted in Simulation in Social Science: Readings, Harold Guetzkow, ed.).

"The rub of the simulation problem involves the use of similar types of 'programs' of 'instructions' to the machine in order to reproduce the steps an individual goes through in thinking out the solution to a difficult problem." Simulation methods "have a tremendous role in sharpening our formulations concerning mental processes and phenomena." The "simulation of human responses has the same overwhelming advantages for our understanding of behavioral phenomena as similar methods in other sciences." Research "on simulation of complex psychological processes is yielding results of increasing importance."

380 Hovland, C.I. and E.B. Hunt. COMPUTER SIMULATION OF CONCEPT ATTAINMENT. Behavioral Science, 5, 265-267, 1960.

The process of concept attainment lends itself readily to simulation by use of high speed computers. This paper describes computer simulations in which the subject (or machine) knows the dimensions which will be used, the number of values of each, and the number of dimensions and values required to define the concept.

381 Howard, Warren D. THE COMPUTER SIMULATION OF A COLONIAL SOCIO-ECONOMIC SYSTEM. Proceedings of the Western Joint Computer Conference, 1961. Western Joint Computer Conference, Los Angeles, California, 613-619, 1961.

One might view the international political world as a system of nations, each described by a unique transfer function. Existing system engineering

methods and computer techniques might then be applied to this multi-variable system with the hope that a better understanding might be achieved for the rise of international problems and their subsequent solution.
This paper describes the design, and actual demonstration by analog computer techniques, of a colonial socio-economic system which included national growth and national behavior models.
The national growth model included such variables as resource, opportunity and incentive with the hopes of evaluating the asymptotic behavior of the total population. The national behavior model described which one of the two political alternatives would be advocated by elements of the organized native class based on the environment defined by the growth model.

382 Hufford, Lyle E. SIMULATION: DESIGN DEVELOPMENT AND TRAINING. Paper presented at Human Factors Symposium, California State College at Los Angeles, June 20, 1964.

A description of what has been learned of simulation techniques and requirements during conventional aviation research which will carry over and be expanded upon in space research and development efforts. Of special interest is the usefulness of simulation in the development of space vehicles.

383 Hulbert, S. and C. Wojcik. DRIVING SIMULATOR DEVICES AND APPLICATION. A paper in two parts. Society of Automotive Engineers, Automotive Engineering Congress, Detroit, Michigan, January 1964.

384 Human Resources Research Office. HUMRRO BIBLIOGRAPHY OF PUBLICATIONS, AS OF 30 JUNE, 1966; INTERIM BIBLIOGRAPHY OF PUBLICATIONS -- 1 JULY TO 31 DECEMBER, 1966. The George Washington University, Human Resources Research Office, Alexandria, Virginia, March 1967.

385 Hunt, Earl. THEOREM PROVING TECHNIQUES: SOME CASE STUDIES IN PROBLEM SOLVING BEHAVIOR. Mimeographed paper, 1966.

A discussion of a method for finding good problem solving methods is proposed in this paper, as well as its application, illustrated by a discussion of a particular type of problem solving, formal theorem proving.

386 Hunt, E.B., Janet Marin and P.J. Stone. EXPERIMENTS IN INDUCTION. Academic Press, New York, 1966.

The book deals with Concept Learning System (CLS) which is a series of computer programs which were originally designed to simulate human problem solving behavior. Main emphasis is on CLS-1.

387 Hunt, E.B. and C.I. Hovland. PROGRAMMING A MODEL OF HUMAN CONCEPT FORMULATION. Proceedings of the Western Joint Computer Conference, 19, 145-155, 1961. (Reprinted in Computers and Thought, Feldman and Feigenbaum, eds.).

A model of human information processing during concept formation has been constructed, using a list processing, digital computer program. The program's input consists of descriptions of objects in terms of dimensions and values. The universe of objects is divided into two or more sets. The program attempts to form a decision rule, based upon the descriptions of the objects, which can be used to assign any previously presented or new object to its correct set.
The program is a model for human information processing, rather than an artificial intelligence system. It contains features which limit the number of objects in internal memory and the number of dimensions which may be involved in an answer. Using this program, simulations have been performed of a number of psychological experiments in concept learning. Comparison of these simulations with the data obtained from human subjects is discussed in the paper.

388 Hunter Harold G. and Eugene A. Cogan. TRAINING MODELS: I. THE FORMULATION OF TRAINING PROBLEMS. II. MODELS OF AND FOR TRAINING. Professional Paper 13-66. George Washington University, Human Resources Research Office, Alexandria, Virginia, December.1966.

The first paper stresses the systems approach to military training. It is divided into three sections which (1) sketch out a chronology of functions that have been found fruitful in establishing and maintaining effective programs, (2) takes up some problems in getting from an abstract formulation to the real world of military training, and (3) suggests some areas where research might pay off in substantial gains for increased training effectiveness at lower training costs.
The second paper is a reconstruction of remarks synthesizing and summarizing the presentations and discussion in the Human Factors working group session on training models.

389 Hurd, C.C. SIMULATION BY COMPUTATION AS AN OPERATIONS RESEARCH TOOL. Or Jorsa, 2,2, May 1954.

390 Hurley, J.R. and J.J. Skiles. DYSAC: A DIGITALLY SIMULATED ANALOG COMPUTER. AFIPS Conference Proceedings, 23, 1963 Spring Joint Computer Conference. Spartan Books, 1963.

A digital computer program which simulates a large electronic analog computer has been written for the CDC 1604 digital computer. This digital computer program, called DYSAC, an acronym for Digitally Simulated Analog Computer, is, in reality, a complete programming system, and as with FORTRAN, has a special language to facilitate its use.

391 Husband, James Harris. DIGITAL SIMULATION OF A LOAD-PEAKING GENERATION STATION LOCATED IN A TIDAL ESTUARY M.S. thesis, Oregon State University, 1966.

The use of tidal energy for electrical power generation represents the utilization of a natural resource not currently exploited by utility systems. Such a facility becomes more useful to the utility company when the peak-load generating capacity of this type of plant can be forecasted for any one day in a year. One manner by which this capacity can be forecasted is by the use of a simulation on a digital computer. This thesis develops the use of a digital simulation as a tool that can be used to predict the capability of this facility.

392 Hutchins, B.B. and W.H. Nichols. COST COMPARISON: LIVE VS SIMULATED SYSTEMS MISSIONS. System Development Corporation, Santa Monica, M-25032, October 1962.

393 Hutchinson, George K. A COMPUTER CENTER SIMULATION PROJECT. Communications of the ACM, 8(9), 559-568.

Today's computation centers are based on rapidly changing technologies of hardware and software systems. It is difficult, therefore, to base decisions on experience. Experiments performed with a mathematical model of a computation center in terms of information nets, decision processes, and control functions, the results of the experiments, and the application of the results are discussed.

394 Hutte, Herman. DECISION-MAKING IN A MANAGEMENT GAME. Human Relations, 18(1), 5-20, 1965.

The expectation that out of a number of 12 teams of 4 persons, playing 3 management games (4 teams playing against each other in each game), a number would be highly centralized regarding decision-making, was not fulfilled. On the contrary it was found that strong forces were operating against such centralization. The influence of the total environment on formal properties of the decision process in terms was much stranger than was expected.

395 Iannizzi, Elizabeth. BUSINESS EDUCATION THROUGH EXPERIENCE IN MAKING DECISIONS. Business Education Forum, 21, 9-13.

Business education can learn much about teaching from business itself—especially new techniques for simulating office situations and thus forcing the learner into realistic decision making. One such project, "lifted" from a management conference sponsored by the Cornell University School of Labor Relations and adapted to the secretarial field, is the "in-basket". This paper describes how this technique can be applied to teaching, as demonstrated by its use at the City University of New York.

396 Illinois, University of. REPORT TO THE FACULTY. College of Medicine, Office of Research in Medical Education and Center for the Study of Medical Education, Chicago, 1966.

Topics include (1) Educational Activities, (2) Research and Development programs, (3) Service responsibilities, and (4) Activities with outside groups. Included in the appendices is the title A Study of New Oral Examination Methods, which presents experimental work with a Simulated Diagnostic Interview, a Simulated Treatment Interview, and a Simulated Patient Management Conference.

397 Illinois, University of. MATERIALS FOR THE EVALUATION OF PERFORMANCE IN MEDICINE. The Evaluation Unit, Center for the Study of Medical Education, College of Medicine, Chicago, January 1967.

Included: (1) Introduction to collected materials - Enumeration and explanation of five procedural steps for assessment of students. (2) Simulation Technique in the Evaluation of Clinical Judgement - A general description of simulation exercises with procedures for constructing, scoring, setting standards of competence and analyzing the results from a simulation exercise. Also included is a sample problem in patient management. (3) Oral and Practical Examinations - Methods for improving or designing oral and practical examinations.

398 Inbar, Michaël. THE DIFFERENTIAL IMPACT OF A GAME SIMULATING A COMMUNITY DISASTER. American Behavioral Scientist, 10(2), 18-27, 1966.

Group effects, pre-disposition of the players and capability of the game administrator are investigated as factors accounting for the differential impact of simulation games.

399 Inbar, M. THE DIFFERENTIAL IMPACT OF A GAME SIMULATING A COMMUNITY DISASTER AND ITS IMPLICATIONS FOR GAMES WITH SIMULATED ENVIRONMENTS. The Johns Hopkins University, Department of Social Relations, Baltimore, Unpublished Doctoral Dissertation, ABS, October 1966.

400 Inbar, M. SIMULATION OF SOCIAL PROCESSES: THE DISASTER GAME. The Johns Hopkins University, Department of Social Relations, Baltimore, 1965.

401 Ingham, G.E. SIMULATED ENVIRONMENTS FOR INDIVIDUALIZED INSTRUCTION. Audiovisual Instruction 9: 410-411, 1964.

A description of the "Bedford project", which was organized by the Board of Cooperative Educational Services of the First Supervisory District of Westchester County, New York. A U.S. Office of Education sponsored project, the title given it was "An investigation of the suitability of simulated environment modes for individualizing instruction in selected areas of education".

402 Ingraham, L.W. TEACHERS, COMPUTERS, AND GAMES: INNOVATIONS IN THE SOCIAL STUDIES. Social Education, 31: 51-53, 1967.

A description of computer-based games for 6th-grade Social Studies which were developed by the Board of Cooperative Educational Services in Westchester County, New York, in cooperation with International Business Machines, Inc. The "Sumerian Game," the "Sierra Leone Development Project" game, and the "Free Enterprise Game" are discussed and described.

403 International Business Machines, Reference Manual: General Purpose Systems Simulator II. IBM Technical Publication, 1963.

A computer program to aid system-study work. Allows the user to study the logical structure of the system.

404 Irvine, N.L. and L. Davis. SIMULATION BY MODELING. Proceedings of the Western Joint Computer Conference. Institute of Radio Engineers, New York, 13-16, March 1955.

Many complex phenomena may be studied effectively by simulation techniques: one of these is the design of multi-dimension filters, sometimes called space filters.

405 Jackson, James R. BUSINESS GAMING IN MANAGEMENT SCIENCE EDUCATION. Proceedings of the Sixth International Meeting of the Institute of Management Sciences, Paris, 1, 250-262, September 7-11, 1959 (Published 1961).

The use of decision gaming in the business school at the University of California, as part of courses in the management science research area, is discussed. An experiment using a new executive game proved encouraging but inconclusive.

406 Jackson, James R. LEARNING FROM EXPERIENCE IN BUSINESS DECISION GAMES. California Management Review, 1(2), 92-107, 1959.

This paper is a survey of the types and uses of business-gaming as a tool for the training of managers.

407 Jackson, J.R. SIMULATION RESEARCH ON JOB SHOP PRODUCTION. Naval Research Logistics Quarterly, 4 (4), December 1957.

408 Jackson, R.R. and D.G. Nickols. ECONOMICS OF THE HIRING OF PRIVATE WIRES IN GREAT BRITAIN: A SIMULATION STUDY. Operational Research Quarterly, 9 (1), March 1959.

409 Jacobson, Robert V. DIGITAL SIMULATION OF LARGE-SCALE SYSTEMS. In: 1966 Spring Joint Computer Conference, AFIPS Conference Proceedings, 28, (159-164), Spartan Books, 1966.

The purpose of this paper is to examine the process of simulating systems, and so to suggest some causes of dissatisfaction and their remedies.

410 Jenkner, K. FEASIBILITY STUDY FOR A FOG SIMULATOR,PHASE III. Link Division, General Precision, Inc., Binghamton, New York, October 1961.

This report is concerned with the development of a technique for controlled deposition of simulated fog particles on the plastic film to be used in the simulator. A successful method of utilizing clear lacquer deposited by air brush on mylar film is described.

411 Jennings, N.H. LOADING AND SCHEDULING BY SIMULATION METHODS. Operations Research Reconsidered, AMA Report No. 10, 1958.

412 Jennings, Norman H., and Justin H. Dickens. COMPUTER SIMULATION OF PEAK HOUR OPERATIONS IN A BUS TERMINAL. Management Science, 5, 106-120. 1958. (Reprinted in Simulation in Social Science: Readings, edited by Harold Guetzkow).

> The mechanism of a flexible computer program for simulating operations (such as evaluating the effect of the length of a single-lane bus platform) can be effective for simulating operations of the complete peak hour, also. Proposals for improving operations can be examined and tested by this method, avoiding disruption of service that would result from protracted trial-and-error experimentation in actual operations.

413 Jensen, B.T. and N. Jordan. A PROPOSAL FOR A RESEARCH PROJECT ON THE DEVELOPMENT OF CREWS IN GENERAL AND MAN-MACHINE SYSTEM CREWS IN PARTICULAR. TM 361, System Development Corporation, Santa Monica, California, 1959.

414 Jensen, B.T. and C.H. Kepner. BEHAVIORAL CHANGE AND THE IDEAL. SSTP, SD-1604, System Development Corporation, Santa Monica, California.

415 Johnson, D.L. and A.D.C. Holden. SIMULATION OF HUMAN PROBLEM-SOLVING METHODS. Simulation, 3(2), 65-70, 1964.

> This brief paper deals with the heuristics of human problem solving. More specifically it discusses the method of finding sequences of transformations which constitute proofs of trigonometric identities. The method is adaptive (learning) and not of the exhaustive search variety. The system was developed for IBM 709 and originally used the COMIT language (later changed to SNOBOL).

416 Johnson, Edward S. AN INFORMATION-PROCESSING MODEL OF ONE KIND OF PROBLEM SOLVING. Psychological Monographs, 78 (4), whole No. 581, 1-31. 1964.

Solutions to a set of concept-formation problems were secured individually from 11 Ss using a thinking-aloud procedure. The task required Ss to propose a sequence of hypotheses concerning properties which differentiate one set of patterns from another set. Verbal transcripts were analyzed in detail for consistencies in the ways in which Ss produce hypotheses. A method of low-level scanning was identified which forms the basis for generating simple hypotheses. More complex (disjunctive and conjunctive) hypotheses were found to be compounded from simple consistencies found in the pattern sets. Points of individual difference relating to the complexity of hypotheses formed, degree of validity checking, persistence, etc., were identified. An information-processing model was constructed which was judged to be successful in the simulation of problem-solving behavior of several Ss on a variety of problems.

417 Johnson, J.W. ON STOCK SELECTION AT SPARE PARTS STORES SECTIONS. Naval Research Logistics Quarterly, 9(1) 49-50, (March 1962).

This is a case history of a project performed for the Royal Canadian Ordnance Corps. The author reports on a simulation model designed to investigate various policies for stocking spare parts and for their replenishment. It is claimed that the recommended policy would result in a 24% increase in spare parts availability, and result in annual savings of about $300,000 in operating costs.

Jack Moshman, Arlington, Virginia

418 Johnson, R.H. et. al. COED -- A DEVICE FOR THE EXPERIMENTAL STUDY OF MAN-MACHINE SYSTEMS. Journal of the Human Factors Society, 3(1), 60-65, 1961.

A description is given of an experimental facility for investigating man-machine system design problems. The facility is called the COED (Computer Operated Electronic Display). It combines a very large capactiy cathode ray tube (Digitron) with a high-speed computer (IBM 704). The components, programming, and uses of the device are described.

419 Jones, Edna M. and J.B. Fairman. IDENTIFICATION AND ANALYSIS OF HUMAN PERFORMANCE REQUIREMENTS in J.D. Folley (Ed.), Human Factor Methods for System Design, Pittsburgh, Pennsylvania: Chapter 3, 43-62, 1960.

The material presented in this article naturally follows and amplifies Munger's (1960) identification and analysis of personnel functions from a previous chapter in Folley. The major headings are: "Task Derivation", "Task Analysis", "Task Analysis Data Formats", and "Time Line Analysis". The authors caution: "In applying the results of the time line analysis to other portions of the human factors program, the analyst should be wary of too literal an interpretation of the results. ... The times required for the performance of these complex behaviors [functions allocated to man] are very difficult to estimate."

420 Kahn, Herman and Irwin Mann. WAR GAMING. P-1167, The RAND Corporation, July 30, 1957.

421 Kappler, M.O. AUTOMATED INFORMATION-PROCESSING ASSISTANCE FOR MILITARY SYSTEMS. TR-2. System Development Corporation, Santa Monica, California, 1961.

422 Karam, F.X. and R.G. Mueller. THE STP FOR AIR DEFENSE (DISASTER CONTROL: SIMULATION AND USE). TM-590, January 31, 1961.

423 Karr, Herbert W. A QUICK LOOK AT SIMSCRIPT. In: Simulation models for education, 4th Annual Phi Delta Kappa Symposium on Educational Research, Nicholas A. Fattu and Stanley Elam, (Eds.), Phi Delta Kappan, 59-103, 1965.

> This paper describes a programming system specially adapted to the problems of writing simulation programs, called SIMSCRIPT.

424 Katcher, A. and M. Hunter. HOW TO LEAD A DEBRIEFING -- A GUIDE FOR SENIOR DIRECTORS, TM-132. System Development Corporation, Santa Monica, California, November 1957.

425 Katz, J.H. SIMULATION OF A MULTIPROCESSOR COMPUTER SYSTEM. In: 1966 Spring Joint Computer Conference, AFIPS Conference Proceedings, v. 28, Spartan Books, 127-139, 1966.

> With the advent of multiprocessor computer systems the prediction of computer system performance on a prescribed job load has become a problem of considerable complexity. This paper has described a model whose principal purpose is to ease this problem, by using the system-state approach.

426 Katz, Jesse H. SIMULATION OF A TRAFFIC NETWORK. Communications of the ACM, 6(3), 480-436, 1963.

> A description of a computer program to simulate an automatic traffic network. The primary purpose was to evaluate the effect of traffic signal settings on traffic flow in a region of a city. The simulation provides a tool which helps optimize the timing of traffic lights.

427 Kaufman, H. and G.M. Becker. THE EMPIRICAL DETERMINATION OF GAME-THEORETICAL STRATEGIES. Journal of Experimental Psychology, 61, 462-468, 1961.

Strategies chosen by players in a real game situation were compared to those given by game theory in order to determine how readily, if at all, naive persons adopt "optimal" rational solutions. The results indicate that individuals differ markedly in their ability or willingness to adopt a theoretic strategy. However a majority of Ss did achieve a game solution in at least one of the five games played. The degree to which the players approximated the game theory was a function of the optimal strategy associated with each game.

428 Kellogg, M.C. DRAWBACKS OF SIMULATION. Presented at the American National Meeting of TIMS, Chicago, June 1959.

429 Kenneally, W.J., et al. HYBRID SIMULATION OF A HELICOPTER. IN: 1966 Spring Joint Computer Conference. AFIPS Conference Proceedings, Spartan Books, 28, 347-354, 1966.

In the Avionics laboratory, the problem of defining system performance characteristics for advanced avionics has in turn generated a requirement for analyzing the tactical mission envelope of both existing and advanced Army aircraft. One aspect of this particular task -- that of evaluating avionics systems synthesized to provide particular mission capabilities has resulted in the development of a unique man-machine known as the Tactical Avionics System Simulator.

430 Kennedy, John L. ENVIRONMENT SIMULATION AS A TECHNIQUE FOR STUDYING HUMAN BEHAVIOR. 1st Congress Information System Sciences, Session 7, 101-111, Mitre Corporation, Bedford, Massachusetts, 1962.

Many basic questions are asked in this paper concerning the interpretation of experiments on man-machine systems. Extensive environment simulation of war and business games can be used to study the interaction of human behavior with computers in information processing systems. One examples of each type is given, using a man-centered air defense data processing unit and a stock exchange business game.

The contention is that the man's flexibility may make him superior at processing complex data, while the rational program of a computer could be advantageous in long-range strategy as against the vacillating policies of an operator. The examples are not convincing because the first puts a fixed system analysis in a situation requiring adaptability, while the second constrains the adaptable human in a game with fixed rules. However, the author's object is not to prove his point-of-view but to provoke discussion on it, and this he does.

H.C. Ratz, Saskatoon, Canada

431 Kennedy, J.L., J.E. Durkin, and F.R. Kling. GROWING SYNTHETIC ORGANIZMS IN SYNTHETIC ENVIRONMENTS. Unpublished paper, Princeton University, 1960.

432 Kersh, Bert Y. THE CLASSROOM SIMULATOR: AN AUDIO-VISUAL ENVIRONMENT FOR PRACTICE TEACHING. Audio-Visual Instruction, 6(9), 447-448, 1961.

A description of the facility called the Classroom Simulator, (located at Oregon's newly established Center for Research on Teaching, now called Teaching Research), which was built to allow techniques to be developed for simulating a variety of classroom situations to which student teachers could react.

433 Kersh, Bert Y. SIMULATION IN TEACHER EDUCATION. Paper read as part of the Symposium "Programed Learning and Teacher Education", at the Annual Convention of the APA, St. Louis, 1962.

This report concerns a particular problem in teacher education, the development of specific skills in classroom instruction, involving one application of the simulation technique discussed in this paper. The technique of classroom simulation, and how the simulation materials will be used in the Classroom Simulator, is described.

434 Kersh, Bert Y. CLASSROOM SIMULATION: A NEW DIMENSION IN TEACHER EDUCATION. Final Report, Title VII Project No. 886, Teaching Research Division, Monmouth, Oregon, June 1963.

The experiment was designed to show the need for "realism" in simulation by comparing combinations of extremes in two different stimulus dimensions. (1) size, (2) motion. Criterion measures used to evaluate the effectiveness of transfer were peformance ratings in the Classroom Simulator. Results indicated that the small screen projection was superior to life size projection and that there was no difference between the still and moving pictures. Still projections did require fewer training trials. Although small projections were most effective in the present experiment, the author concludes that the data are not sufficient to say that the more economical small still mode of presentation is as adequate as life-size motion pictures in instructional simulation.

435 Kersh, Bert Y. CLASSROOM SIMULATION: FURTHER STUDIES ON DIMENSIONS OF REALISM. Final Report, Title VII, Project No. 5-0848, Teaching Research Division, Monmouth, Oregon, December 1965.

The purpose of the study was to examine selected instructional variables in the classroom simulation technique to provide a sound basis for further development. Findings of the recently completed research on dimensions of realism, therefore, have important theoretical as well as practical implications. If the transfer effects of instruction in the simulated classroom are not related to instructional variables involving size of image and mode of response, the same instructional materials could be adapted for use on a broader scale at lower cost. The findings indicate that the small projections result in higher post-test scores than life-size (realistic) displays. Results from experiment II indicate no significant differences in post-test scores between subjects who enacted and subjects who verbalized their responses. This result adds further support to the suggestion that classroom simulation may be adapted to individualized or group-paced instruction where the projections are smaller than life-size and responses are described.

436 Kibbee, Joel M. MANAGEMENT CONTROL SIMULATION. In: Management control systems, Donald G. Malcolm and Alan J. Rowe, (Eds.), Wiley, 300-320, 1960.

This paper discusses and describes a simulation model used in the study of management control systems, and certain business games which are related to such simulation, and offers a proposal for a preliminary model.

437 Kibbee, Joel M. MANAGEMENT GAMES AND COMPUTERS. In: Proceedings of the Western Joint Computer Conference, Papers presented at the Joint IRE-AIEE-ACM Computer Conference, Los Angeles, California, May 9-11, 1961. Western Joint Computer Conference, 1961.

Management games, although a relatively new educational technique, are being widely utilized, and much discussed. They are primarily of concern to the educator and to the research scientist, but since many of these games are played with the aid of an electronic computer, they should be of interest to computer people in general. In addition to the use of a computer for existing games, new games are being developed and will require programming. Many papers have been published on the educational aspects of management games; this paper has been written primarily to arouse interest in them as a computer application.

438 Kibbee, J.M., C.J. Craft, and B. Nanus. MANAGEMENT GAMES: A NEW TECHNIQUE FOR EXECUTIVE DEVELOPMENT. Reinhold, New York, 1961.

Management games as a technique for simulating business problems for training purposes in a "laboratory" situation susceptible to experimentation and analysis, and free from the monetary losses which accompany miscalculation in real life. Games are extremely powerful in demonstrating the interrelationships of decision areas and the role of balanced, long-range planning in achieving corporate objectives.

439 Kidd, J.S. A NEW LOOK AT SYSTEM RESEARCH AND ANALYSIS. Human Factors, 4(4), 209-216, August 1962.

"This report is an attempt to integrate some conceptual and methodological divergencies in man-machine system research. A conceptual format and a procedure for input analysis are proposed which are derived from a cybernetics model. The format is suggested as a means to organize theoretical propositions. Some problems related to organize theoretical propositions. Some problems related to real-time simulation as a research method for system research are considered and an approach to methods improvement is discussed."

440 Kimmel, P.R. and J.W. Havens. GAME THEORY VERSUS MUTUAL IDENTIFICATION: TWO CRITERIA FOR ASSESSING MARITAL RELATIONSHIPS. Journal of Marriage and Family, 28(4), 460-465, 1966.

Mutual identification appears to be the normative pattern of interdependence anticipated by middle-class American couples and endorsed by most professionals in marriage. To assess the quality of a relationship by evaluating individual behavior is to deny this normative pattern. The application of game theory to marital interaction is an example of such a denial, since it assumes that players interact on the basis of individualized self-interest in a mutually incompatible issue. If this perspective prevails in a marriage, mutual identification is hampered.

441 Kinley, Holly J. DEVELOPMENT OF STRATEGIES IN A SIMULATION OF INTERNAL REVOLUTIONARY CONFLICT. American Behavioral Scientist, 10(2), 5-9, Part II, 1966.

The particular concern of this paper is with the strategic choices available to a participant in an internal revolutionary war. In circumstances where a process so little understood and so complex is to be analyzed, it is often fruitful to proceed by means of modeling and simulation. A model may be defined as a simplified representation of a process (usually a complicated process), and a simulation as the exercise of operation of that model.

442 Klahr, David. A COMPUTER SIMULATION OF THE PARADOX OF VOTING. American Political Science Review, 60(2), 384-390, 1966.

This paper presents estimates of the probability that the occurrence of the Paradox of Voting, commonly known as Arrow's Paradox, will prevent the selection of a majority issue when odd-sized committees of *m* judges vote upon *n* issues. The estimates, obtained through computer simulation of the voting process, indicate that the probability of such an intransitive social ordering is lower than the ratio of intransitive outcomes to all outcomes.

443 Klaus, David J. *et al*. INCREASING TEAM PROFICIENCY THROUGH TRAINING: 6. SUPERVISORY FURNISHED REINFORCEMENT IN TEAM TRAINING. American Institute for Research, Pittsburgh, Pennsylvania.

This study assesses the potential advantages of simulated supervisory reinforcement used to enhance the speed of team response acquisition.

444 Knorr, Klaus, and Sidney Verba (Eds.) THE INTERNATIONAL SYSTEM: THEORETICAL ESSAYS. Princeton University Press, Princeton, New Jersey, 1961.

A collection of papers dealing with the dilemma involved in the application of theory -- "the more we attempt to apply theory, the more we lose the unique advantages of theory. And yet why else do we want theory, if we do not at some point want to apply it?" The papers in this volume raise the question of what sorts of simplifying assumptions have been made in theories of international relations, what significant variables have been left out of the models of the international system, and what is the price of attempting to put them back in. Specifically, several papers discuss the problems associated with the use of game theoretical models and with the assumption of rationality of the actors in international affairs.

445 Komorita, S.S. COOPERATIVE CHOICE IN A PRISONER'S DILEMMA GAME. *Journal of Personality and Social Psychology*, 2(5), 741-745, 1965.

Using a two-person, Prisoner's Dilemma game, two related experiments were conducted to test the hypothesis that individuals would reciprocate cooperative behavior by a simulated partner. The first study systematically varied the conditional probabilities of cooperative and competitive responses by the simulated partner, given cooperative and competitive responses by S, respectively. The second study tested the effects of a simulated partner who matched the previous responses of S. In general, most Ss did not reciprocate cooperative choice. However, a marked sex difference was obtained. Males reciprocated cooperative choice more than females when such behavior maximized gain, but reciprocated less when such behavior was nonoptimal.

446 Kopstein, F.F. and Isabel J. Shillestad. A SURVEY OF AUTO-INSTRUCTIONAL DEVICES. Behavioral Sciences Laboratory, Aerospace Medical Laboratory, Aeronautical Systems Division, Air Force Systems Command, United States Air Force, Wright-Patterson Air Force Base, Ohio, September 1961. 119pp. incls. illus. (AD 268 223)

Report summarizes the state of the art of auto-instruction and teaching devices to April 1961 in the interest of suggesting possible applications. Included is a review of auto-instruction (part I) and a catalog-description of all major current auto-instructional devices.

447 Knutson, H.C. SOURCE BOOK ON THE APPLICATION OF RESEARCH TO GROUND TRAINING IN AVIATION. Technical Report, Contract N7 ONR-383(01), Richardson, Bellows, Henry and Co. Inc., New York, May 1949.

Research summaries: Study skills, Establishing the curriculum, Evaluating proficiency, Validation of training procedures (General), Student attrition, Mass training, Instructor training, Training in perceptual ability (Vision), Aircraft recognition training, Speech-hearing perceptual training. Kinesthetic (Motor) training, Audio-visual aids (Special devices), Air validation (Transfer of training from ground to air).

448 Kraft, Ivor. PEDAGOGICAL FUTILITY IN FUN AND GAMES? National Education Association Journal, 56, 71-72, 1967

Kraft rejects the idea that social studies are appropriate subject matter for game playing. Says Kraft, "few if any students will acquire a deeper understanding of social processes by playing games of the kind developed at Johns Hopkins." This article is accompanied by one written by James Coleman which defends the use of games in social studies.

449 Kribs, Charles A. BUILDING A MODEL USING SIMPAC. Technical Memo No. TM-602/300/00, System Development Corporation, Santa Monica, California, November 1962.

A modeling of a system using SIMPAC (Simulation Package) is described. A hypothetical computer shop based on the IBM 7090 installation at SDC was chosen as the system to be modeled. This model is not intended to represent the complete computer complex or to be all-inclusive in the specific area chosen, but is intended to show the methods and applicability of SIMPAC. SIMPAC is defined as a package which includes both a method of modeling and a means of expressing and manipulating the model.

450 Kuehn, A.A. and R.L. Day. SIMULATION AND OPERATIONAL GAMING. In: Marketing and the computer, W. Alderson and S. Shapiro, (Eds.). Prentice-Hall, 234-247, 1962.

Computer models based on business operations are now being used in many ways. The educational use of computer models in business games has tended to overshadow their application to the analysis of actual business operations. However, an increasing amount of interest is being shown in the development of simulation models and operational games. This article discusses the nature of these promising new tools and illustrates their use in a marketing context.

451 Kuehn, Alfred A. and Doyle L. Weiss. MARKETING ANALYSIS TRAINING EXERCISE. Behavioral Science, 10(1), 51-67, 1965.

"Gaming" as a training technique has recently been given a new form in the military sphere, and introduced in business in this modern form. It has also been applied in the foreign policy sphere. In addition to being a training technique, gaming is a research tool. It forces the research worker to formulate the essentials of a complex social situation in an articulate way, and, if it is permissible to extrapolate from the behavior of the trainees to that of people who make decisions in real life, complex gaming services the purposes of a laboratory experiment in behavior.

452 Kuhn, Harold, W. GAME THEORY AND MODELS OF NEGOTIATION. Journal of Conflict Resultion, 6(1), 1-4, 1962.

A review of a conference held October 7, 1961, at Princeton University under the auspices of the Institute for Defense Analyses, which was devoted to the Applications of Game Theory to Negotiation. Discussion centered around the potential applictions of game theory to international negotiation.

453 Kulik, Barbara J. A COMPARISON OF THEORECTICAL BEHAVIOR WITH OBSERVED BEHAVIOR IN A TWO-PERSON ZERO-SUM INTERACTION. Arizona State University, Tempe, June 1965.

"Two male subjects played five two-person zero-sum games involving two or three strategy choices per person. It was observed that games with pure strategy solutions could have these solutions approximated within 30 trials or less but that solutions to the mixed strategy games could not be approached within 50 trials. The subjects, though instructed, did not always behave in the 'rational' way of following the minimax principle."

454 Lackner, Michael R. DIGITAL SIMULATION AND SYSTEM THEORY. Document No. SP-1612. System Development Corporation, Santa Monica, California, 1964.

Consideration of the problem of describing dynamic systems and study of digital simulation methodology have led to the identification of a relation describing change, which can be used in conjunction with existing logical and mathematical relations for characterizing systems. In this paper, simulation and modeling are discussed and a calculus featuring a change relation is introduced.

455 Lackner, M.R. SIMPAC: A RESEARCH TOOL FOR SIMULATION. (SDC document SP-228). System Development Corporation, Santa Monica, California, March, 1961.

SIMPAC is a research tool designed for the implementation of system simulation. SIMPAC provides a macro language, for constructing a model, and a computer program which will move the model through time. The program produces output descriptive of the operation of the system. The class of systems susceptible to simulation with SIMPAC is one which can be adequately modeled as a queue-server network. The network may be complex; the queues may be subject to dynamic queue disciplines; the servers may have dynamic capacities; and the individual members of queues, referred to in this paper as transactions, may be identifiable.

456 Lacker, Michael R. TOWARD A GENERAL SIMULATION CAPABILITY. In: Simulation models for education: Fourth Annual Phi Delta Kappa Symposium on Educational Research. Phi Delta Kappa, 29-57, (Reprinted from Spring Joint Computer Conference, AFIPS Conference Proceedings, 1962, 1-14). 1965.

An introductory discussion of digital simulation which outlines problems involved in modeling and implementation is given. A discussion of SIMPAC, describing the modeling and simulation techniques employed and their application, is also provided.

457 Lanyen, Richard I. SIMULATION OF NORMAL AND PSYCHOPATHIS MMPI PERSONALITY PATTERNS. Journal of Consulting Psychology, 31(1), 94-97, 1967.

27 well-adjusted and 42 maladjusted college males took the MMPI under instructions to simulate very good adjustment, and again under instructions to simulate psychopathic personality. Both groups simulated very good adjustment satisfactorily; however, well-adjusted Ss were superior to maladjusted Ss in the simulation of psychopathic personality. The findings were consistent with the literature on role-taking and empathy, supporting the view that good adjustment involves an ability to understand and predict socially adequate and inadequate behavior.

458 Larrowe, U.L. DIRECT SIMULATION BYPASSES MATHEMATICS, SIMPLIFIES ANALYSIS. Control Engineering, 1(3), 25-31, 1954.

This article describes a concept which simplifies simulation. The computer circuit is built from functional blocks, which are direct analogs of components in the system to be simulated. The system's dynamic equations need never be written. A simplification of analysis.

459 Laski, J.G. ON TIME STRUCTURE IN (MONTE CARLO) SIMULATIONS. Operational Research Quarterly, 16, 16(3), 329-339, September 1965.

Event and Activity based simulation modeling systems are compared. A new system called a Disaggregrated Activities List approach is proposed that combines the execution efficiency of an Event system with the model formulation simplicity of an Activity system. The proposed systems' principal disadvantage is its complexity.

460 Lathrop, John B. and John E. Walsh. SOME PRACTICAL SIMULATIONS OF OPERATIONS. Journal of Industrial Engineering, 9 (5), 392-396, 1958.

For the air cargo example given in this paper, determination of a suitable analytical model is reasonably easy but solution of the analytical problem is not feasible for nontrivial cases. The paper outlines and discusses the simulation procedures of an Air Cargo example.

461 Laughery, K.R. and L.W. Gregg. SIMULATION OF HUMAN PROBLEM-SOLVING BEHAVIOR. Psychometrika, 27, 265-282, 1962.

> In the simulation of human behavior on a digital computer, one first attempts to discover the manner in which Ss internally represent the environment and the rules that they employ for action upon this representation. The interaction between the rules and the environmental representation over a period of time constitutes a set of processes. Processes can be expressed as flow charts which, in turn, are stated formally in terms of a computer program. The program serves as a theory which is tested by executing the program on a computer and comparing the machine's performance with S's behavior.

462 Ledley, Robert S. THOUSAND-GATE-COMPUTER SIMULATION OF A BILLION-GATE COMPUTER. In: Computer and Information Sciences, Julius T. Tou and Richard H. Wilcox (Eds.), Spartan Books, 457-480, 1964.

> The purpose of this paper has been to describe a simulation of a multi-billion-gate computer, where the simulation is intended to be run on a present day "thousand-gate computer".

463 Levitan, Richard and Martin Shubik. MATHEMATICAL STRUCTURE AND ANALYSIS OF THE NONSYMMETRIC GAME. Part IV, Yale University, New Haven, Connecticut, Cowles Foundation for Research in Economics, Report No. Cowles Discussion Paper-219, 1967.

> The prime concern of the paper was the foundation and exploration of an explicit mathematical model of a nonsymmetric oligopolistic market.

464 Lewis, L.G. SIMULATION OF A SOLVENT RECOVERY PROCESS. Instruments and Automation, 31; 4, April 1958.

465 Licklider, J.C.R. MAN-COMPUTER SYMBIOSIS. Institute of Radio Engineers (IRE) Transactions on Human Factors in Electronics, Vol I, 4-11, March 1960.

> Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers. The aims are to let computers facilitate

formulative thinking as they now facilitate the solution of formulated problems, and, secondly, to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs.

466 Lieberman, B. BEHAVIOR IN 2 THREE-PERSON ZERO-SUM GAMES. Paper read at 32nd Annual Meeting of Eastern Psychological Association, April 1961.

467 Lieberman, B. A FAILURE OF GAME THEORY TO PREDICT HUMAN BEHAVIOR. Memorandum, SP-101, Laboratory of Social Relations, Harvard University, 1960.

468 Lieberman, B. HUMAN BEHAVIOR IN A STRICTLY DETERMINED 3X3 MATRIX GAME. Behavioral Science, 5, 317-322, 1960.

The matrix game played was symmetric, and for each player the game had an optimal strategy that did not dominate other alternate strategies. Also, the game contained one nonoptimal strategy with a higher average value than the optimal strategy. The results obtained appear to be a mixture of two types of behavior. One type present in approximately half the Ss was conformity to the minimax model. While the other half deviated from this solution, their behavior continued to show changes to the end of the game, and many of their choices were of optimal strategy.

469 Linker, Eugene and Bruce M. Ross. INTERGAME AND INTRAGAME ANALYSIS OF A PROBABILISTIC GAME. Journal of Genetic Psychology, 101, 113-126, 1962.

Series of 3-choice card games were played between individual Ss and E, who played according to a fixed schedule. Four treatments that varied in difficulty and number of plays per game were administered to college students and the two easier treatments to 8th graders. An intergame - intragame analysis was performed for each treatment. Little intragame learning took place during initial games although intergame learning was large. This uniform result was suggestive of an "hypothesis control" approach by Ss. Final percentage levels of card plays for both easy and difficult college student treatments were well predicted by a "game theory" solution; but 8th graders, though similar in form, required more plays.

470 Little, Arthur D., Inc. THE MARKET OUTLOOL FOR INSTRUCTIONAL TECHNOLOGY. October, 1966.

An examination of present and projected size and character of the educaitonal market for instructional technology, excluding lab supplies.

471 Long, N. THE LOCAL COMMUNITY AS AN ECOLOGY OF GAMES. American Journal of Sociology, 64(3), 251-256, 1958.

The local community can be usefully conceptualized as an ecology of games. In the territorial system a variety of games goes on: banking, newspaper publishing, contracting, manufacturing, etc. The games give structures, goals, roles, strategies, tactics, and publics to the players. Players in each game make use of players in the others for their particular purposes. A banker uses the politician, the newspaperman, or the contractor in his game and is, in turn, used by them in theirs. The interaction of the games produces unintended by systematically functional results for the ecology. An overall top leadership and social games provide a vague set of commonly shared values that promotes co-operation in the system though it does not provide a government.

472 Loubert, J. Daniel. THE TRANS-CULTURAL RESEARCH AND TRAINING INSTITUTE (TCI). Technical Report No. HSR-RR-67/7-Cs, Human Sciences Research, Inc., McLean, Virginia, April 1967.

Thousands of Americans working overseas -- especially U.S. military advisory and training personnel -- hold critical positions which require working closely as co-equals with their foreign counterparts. Unless these individuals somehow acquire the 'feel' of socio-cultural conditions in the host country, they risk partial or total failure in their mission. Many complaints are registered against traditional training which talks about foreign societies. A number of new training techniques, based on experiential training in domestic simulations of foreign societies, seem to offer the possibility of overcoming internalization blockage and permit the trainee to acquire the 'feel and flavor' of basic features of the other culture before his immersion in it. The report suggests that military and civilian government agencies combine with academic, corporate, and other private U.S. organizations to establish a national Trans-Cultural Research and Training Institute with one or more satellite model villages simulating conditions abroad. This would provide the setting for foreign and American trainees and researchers to use, evaluate, and refine experiential training techniques. The Institute would also serve as a national research and information center problems of cross-cultural transfer.

473 Loughary, John W., (Ed.) MAN-MACHINE SYSTEMS IN EDUCATION. Harper and Row, New York, 1966.

This book deals with the nature and application of computers, media technology, and systems technology as they pertain to the instructional, administrative, pupil personnel services, and preparation of staffs for educational institutions in terms of the society of today and tomorrow and as opposed to the society of the past. In the article by Cogswell, "Systems technology in education," a project is described that is making use of techniques relatively new to educational research — systems analysis and computer simulation.

474 Loughary, J.W. MAN-MACHINE SYSTEMS IN EDUCATION. Harper and Row, New York, 1966.

This book concerns itself with the tremendous impact man-machine systems can make in education, understanding something about the nature of man-machine systems and getting a feeling for the various kinds of applications which can be made of them in education. The book is divided into five major parts with fifteen articles by various authors.

475 Loughary, John W., Deloss Friesen, and Robert Hurst AUTOCOUN: A COMPUTER-BASED AUTOMATED COUNSELING SIMULATION SYSTEM. *Personnel and Guidance Journal*, 45, 6-15, Summer 1966.

> Describes the development and initial testing of a computer-based counseling system which attempted to simulate certain counseling behavior of one counselor. Ss interacted with a time sharing computer using TWX input. The basic objective was the similarity of outcomes between the system, model counselor, and second counselor. Criteria included similarity of appraisal statements and course selections. The system agreed with both human counselors on 75% of the appraisal statements and 65% of the course selections.

476 Lucas, K.C. ELECTRONIC COMPUTER SIMULATION OF INVENTORY CONTROL. Proceedings of Conference on Electronics in Action, American Medical Association, New York, 1957.

477 Luce, R.D. A DEFINITION OF STABILITY FOR *N*-PERSON GAMES. *Annual of Mathematics*, 59, 357-366, 1954.

478 Luce, R.D. *K*-STABILITY OF SYMMETRIC AND QUOTA GAMES. *Annual of Mathematics*, 62, 517-527, 1955.

479 Luce, R.D. and E.W. Adams. THE DETERIMINATION OF SUBJECTIVE CHARACTERISTIC FUNCTIONS IN GAMRS WITH MISPERCEIVED PAYOFF FUNCTIONS. *Econometrica*, 24, 158-171, 1956.

480 Luce, R.D. and H. Raiffa. *GAMES AND DECISIONS. INTRODUCTION AND CRITICAL SURVEY*. Wiley, 1957.

481 Lumsdaine, A.A. EXPERIMENTAL RESEARCH ON INSTRUCTIONAL DEVICES AND MATERIALS. In: *Training Research and Education*, Robert Glaser, (Ed.), Wiley, 247-294, 1962.

> This chapter deals primarily with instructional materials and devices as objects of experimental research that is designed to improve the prediction and control of their effects in attaining specific instructional outcomes.

482 Lund, V.E. EVALUATION OF SIMULATION TECHNIQUES TO TEACH DENTAL OFFICE EMERGENCIES. Public Health Service, #PH 108-65-23, Oregon State System of Higher Education, Monmouth, Oregon, 1966. (93pp. including append.).

The purpose of the study was to evaluate four types of prompts used with dental emergency problems simulated on film. The four types of prompts were: 1) no prompt, 2) General Diagnosis prompt, 3) Specific Diagnosis prompt, and 4) Significant signs prompt. The no prompt mode was demonstrated to be most effective and the significant signs prompt was least effective. A general positive attitude was indicated by all treatment groups. Side benefits not anticipated were positive reactions from the chairmen of the basic science departments who liked the idea of composite presentation of materials, and the positive reaction to being able to get together with members of other departments to help bring themselves up to date on developments in other fields.

483 Lund, V.E. TEACHING DENTAL EMERGENCIES THROUGH SIMULATION TECHNIQUES. Final Report; Project #Ph 108-64-77 (p); Department of Health, Education, and Welfare; Public Health Service, June 1965.

Purpose of the study was to study the effectiveness of simulation as a method of presenting emergency situations to dental students and to examine the effects of three response conditions. Results indicate that the three response conditions are equally effective. The author felt, however, that the weaknesses of parts of the procedures and materials called for a redesign and then a new evaluation.

484 Lyon, R.E. RADIATION SIMULATION PROCEDURES FOR DESK TOP IV, FN-5463/001/00, System Development Corporation, Santa Monica, California, July 1961.

485 McAmis, D.M. THE SIMULATOR — NEW IDOL IN TRANSIT TRAINING. Traffic Safety (November 1964).

486 MacCaslin, E.F. IMPROVED MANUALS FOR MAN-MACHINE SYSTEMS THROUGH TASK ANALYSIS. Paper read at U.S. Army-Industry Maintenance Publications Conference, Fort Knox, Kentucky, May 1961.

487 McCelland, W.A. HOW FAR SHOULD TRAINING BE AUTOMATED? or A PERSPECTIVE FOR THE TRAINING MANAGER ON THE AUTOMATION OF MILITARY COURSES OF INSTRUCTION. Paper presented at USCONARC, Fort Monroe, Virginia, June 1961.

> The paper presented three major points: (1) A reasonable decision on the extent of automation can be made only *after* considering a) detailed objectives and b) the most effective training methods for achieving student performance. (2) The teaching machine and programmed textbook incorporate immediate feedback and self-pacing which are not found or not well represented in other training modes. (3) Practical administrative decisions such as integration of automated training with more conventional training and cost/effectiveness must be very carefully considered.

488 McClintock, Charles G. and David M. Messick. EMPIRICAL APPROACHES TO GAME THEORY AND BARGAINING: A BIBLIOGRAPHY. In: *General Systems: Yearbook of the Society for General Systems Research, Ludwig von Bertalanffy and Anatol Rapoport, (Ed.).* 11, 229-238, 1966.

> The following bibliography represents a relatively complete listing of articles, reports, and books, published or available prior to 1966, which are concerned with empirical aspects of game theory and bargaining.

489 McCormick, E.J. *HUMAN FACTORS ENGINEERING.* 2nd. ed. McGraw-Hill, 1964.

> A significant part of this book is given over to discussions of simulation techniques, types of simulation, use of simulation in man-machine systems, and provides many examples of simulations.

490 McCullock, W.S. SYMPOSIUM: THE DESIGN OF MACHINES TO SIMULATE THE BEHAVIOR OF THE HUMAN BRAIN. In: IRE Transactions on Electronic Computers, EC-5, 240-255, 1956.

491 Macdonald, James B. GAMESMANSHIP IN THE CLASSROOM. National Association of Secondary School Principals Bulletin, 50 (314), 51-68, 1966.

Teaching can be considered a special kind of communication game or games, structured by our culture and learned by us. Each game has structure: tole, rules, goals, rituals, language, and values.

492 McClothin, W.H. THE SIMULATION LABORATORY AS A DEVELOPMENTAL TOOL. The RAND Corporation, P-1454, August 1958.

493 McGlothin, W. H. et al. THE SIMULATED AIRCRAFT AND ITS FAILURE MODEL IN LP-1. The RAND Corporation, RM-2177, May 1958.

494 McGrath, J.E. and P.G. Nordlie. SYNTHESIS AND COMPARISON OF SYSTEM RESEARCH METHODS. Human Sciences Research, Inc., Report HSR-RR-60/1-SM, February 1960.

The central objective of Phase I was to review methodologies of system research studies to attempt to construct a useful set of concepts for organizing and comparing research methods, and to evaluate the potential fruitfulness of such an approach for providing a synthesis of system research methods. Phase II was basically an extension of the procedures used in the Phase I feasibility study, in order to modify and elaborate the concepts which had been developed.

In Chapter 6, entitled: "Synthesis and Comparison of System Research Methods", "... a two part approach is seen as being required for a solution to the allocation problem. First, a common, descriptive, quantitative language must be developed which can be applied to man and machine capabilities. Second, a logic of allocation decisions must be formulated. The two are clearly interdependent. The problem will receive major emphasis in Phase III of this research program."

495 McKenny, James L. AN EVALUATION OF BUSINESS GAMES AS A LEARNING EXPERIENCE. Journal of Business, 35, 278-286, 1962.

This article aims to provide evidence that a business game is a more effective method of teaching some aspects of planning than is a series of cases. The author describes an evaluation of the use of a business game as an adjunct to a case course by means of a comparative experiment with two graduate-level classes in production management.

496 McKenncy, J.L. and W.R. Dill. INFLUENCES ON LEARNING IN SIMULATION GAMES. American Behavioral Scientist, 10(2); 28-32, Part I, 1966.

In a business management game, variation of administrative techniques can affect students' attitudes toward the simulation and their performance in the game.

497 McKnight, A. James. PROGRESS REPORT ON TASK NICORD, Briefing booklet, HumRRO, Alexandria, Va., June 1962.

498 McKnight, A. James and Harold G. Hunter. AN EXPERIMENTAL EVALUATION OF A DRIVER SIMULATOR FOR SAFETY TRAINING. The George Washington University, HumRRO, June 1966.

This report describes an empirical evaluation of the effectiveness of an automobile simulator in providing safety training in vehicle operation. A comparison was made with conventional teaching media in twenty-hour safe driving courses administered to several hundred Army personnel who were licensed drivers. The conclusion of the study was that, with substantial modification of current simulator film and equipment to emphasize safe driving practices and attitudes, simulation represents a potentially valuable means of improving driver habits and skills. Further, the results indicate a potential value of automobile simualtors may be of interest to military and other agencies concerned with training for driver safety.

499 McLeod, John. MANNED SPACECRAFT SIMULATION. In: Spring Joint Computer Conference, 1963; AFIPS Conference Proceedings, v. 23, Spartan Books, 401-409, 1963.

A panel discussion (and report) of the combination of two methods of simulation, computer simulation as a technique for the design and evaluation of the complex electro-mechanical systems of the Aerospace industry, and, the use of simulators involving computers for pilot and crew training (for the aerospace industry).

500 McLuhan, Marshall. GAMES, THE EXTENSIONS OF MAN. In: Understanding media: The extensions of man. McGraw-Hill, 1964.

The erudite, controversial professor from Canada describes the importance of games as "an extension of man". "Games", he says, "are dramatic models of our psychological lives providing release of particular tensions." Japan is forging ahead industrially, partly, at least, because they have used the study of classical military strategy and tactics in order to apply them to business operations. Says McLuhan, "The form of any game is of first importance. Game theory, like information theory, has ignored this aspect of game and information movement."

501 McMillan, Claude and R.F. Gonzalez. SYSTEMS ANALYSIS: A COMPUTER APPROACH TO DECISION MODELS. Richard D. Irwin, Inc., Homewood, Illinois, 1965.

A large part of this book is devoted to defining simulation, the usefulness of Systems simulation, a presentation of the general methodology of computer simulation, simulation and decision-making, and descriptions of large-scale simulation models.

502 McNulty, C.F. SIMULATION TECHNIQUES FOR SPACECREW TRAINING STATE-OF-THE-ART REVIEW. USAF MRL techn. docum. Report, No. 62-32, 1962.

The capabilities of the existing simulation technology are discussed and various government and industrial programs for the development of new techniques required for spacecrew training are described. These techniques are divided into categories and discussed in generalities and specifics. The category most basic to the simulation of a system is the development of a suitable set of mathematical models for expressing its characteristics to the degree required. Existing equation techniques are based upon simplications that are not valid for future type vehicles. Classical equations, although not complete, are too complex to be practical for complete simulation. Programs are discussed for the development of new coordinate schemes and generalized aerodynamic and motion equations. The application of special and general purpose analog and digital computers to simulation problems are discussed, and the development of a real-time digital computer and hybrid analog-digital computers which appear most promising for future simulation is reviewed. The requirements for visual capabilities in future training simulation are presented. (19 references).

503 Maffei, R.B. SIMULATION SENSITIVITY AND MANAGEMENT DECISION RULES. Journal of Business, 31(3), 117-186. 1958.

Growing interest by business men in the methods of model-building, experimentation, and integrated data-processing techniques make it increasingly important to be mindful of the limitations imposed upon decision-making by formal methods and by conceptual deficinecies of definitions. Decision tools dictate, in part, information requirements. Single-valued decision rules can be deceptive.

504 Malcolm, Donald G. ARMY BATTALION MAINTENANCE SIMULATION. In: Report of System Simulation Symposium, American Institute of Industrial Engineers. Waverly Press, Baltimore, 1958.

This paper presents a brief description of a simulation approach being used as one of several research tools by the Operations Research Office in investigating operational problems of tactical units in modern warfare.

505 Malcolm, Donald G. BIBLIOGRAPHY ON THE USE OF SIMULATION IN MANAGEMENT ANALYSIS. Operations Research, 8, 169-177, 1960.

This bibliography of system simulation items represents a fair sampling of simulation literature to date (1960).

506 Malcolm, Donald G. SYSTEM SIMULATION -- A FUNDAMENTAL TOOL FOR INDUSTRIAL ENGINEERING. The Journal of Industrial Engineering, 9(3), 177-187. (Reprinted in Simulation in Social Science, Harold Guetzkow, (Ed.) Prentice-Hall, 138-150, 1962.

The purpose of this paper is to develop in a nontechnical manner answers to the questions, What? and How? Who? and Why? facing the industrial engineer interested in what simulation may offer.

507 Malcolm, Donald G. THE USE OF SIMULATION IN MANAGEMENT ANALYSIS: A SURVEY. In: Report of the Second System Simulation Symposium, American Institute of Industrial Engineers, 1959.

508 Manetsch, Thomas Herome. SIMULATION AND SYSTEMS ANALYSIS OF THE UNITED STATES SOFTWOOD PLYWOOD INDUSTRY. Oregon State University, Ph.D. thesis, 1965.

The United States softwood plywood industry is analyzed as a feedback system and simulated on a large scale digital computer. Discussion of system simulation begins with a description of the General System Model which defines several interacting sectors that approximately represent the hundreds of firms interacting in the industry.

509 Markowitz, Harry M. SIMULATING WITH SIMSCRIPT. Management Science, 12(10), B396-B405, June 1966.

Three aspects of SIMSCRIPT enable it to reduce the programming time required for simulation. These are its world-view of the model to be simulated; its method of communicating the world to be simulated to the computer; and its general programming features. This paper describes the first two aspects: the SIMSCRIPT world-view and the SIMSCRIPT approach to simulation programming. (3 references)

510 Markowitz, H.M. and S.E. Cook. A FLOW SHOP SIMULATION MODEL. General Electric Company Technical Information Series R59CD1, Phoenix, 1958.

511 Markowitz, H., E. Hausner, and H. Karr. SIMSCRIPT: A SIMULATION PROGRAMMING LANGUAGE, RAND Research Memo-3310-PR. (Reprinted by Prentice-Hall), 1963.

512 Marks, M.R. DEVELOPMENT OF HUMAN PROFICIENCY AND PERFORMANCE MEASURES FOR WEAPON SYSTEMS TESTING. Psychological Research Associates, ASD TR 61-733, Arlington, Virginia, Decemter 1961. (AD 272-975).

Methods for evaluating human performance are discussed and compared for validity, reliability, objectivity, standardization, and economy. Personnel subsystem test development constraints are considered and methods are proposed for the construction, scoring, administration, and standardization of measurement instruments.

Appendices are included which exhibit sample content, sample computation, and definitions of terms of the Personnel Subsystem.

513 Marshall, A.W. EXPERIMENTATION BY SIMULATION AND MONTE CARLO. The RAND Corporation, P-1174, January 1958.

514 Matin, E.W. Jr. SIMULATION IN ORGANIZATIONAL RESEARCH. Business Horizon, 2(3), 68-77, 1959.

The technique of simulation consists of representing the essential characteristics of organizational systems by means of electronic computers that imitate the operation of a hypothetical system over an extended period, at the same time gathering data and preparing reports on occurrences of interest. By the use of simulation techniques, organizational phenomena and relationships can be studied in a controlled environment.

515 Martin, E.W., Jr. TEACHING EXECUTIVES VIA SIMULATION. Business Horizons, 2(2), 100-109, 1959.

A description of the use of simulation of organizational systems in the management field. Electronic computers are employed to manipulated complex mathematical and logical models in order to dynamically represent certain aspects of the organization's performance over extended periods of time. Simulation shows great promise of providing a laboratory that is invaluable in fundamental research and in teaching.

516 Martin, E.W., Jr. TEACHING MARKETING VIA SIMULATION. In: Marketing concepts in changing times, Richard M. Hill, (Ed.). American Marketing Association, Chicago, 301-315, 1960.

An example of a top management, total enterprise game refereed by an electronic computer utilizing a mathematical model in which the results are completely determined by the decisions, is described.

517 Mattessich, Richard. SIMULATION OF THE FIRM THROUGH A BUDGET COMPUTER PROGRAM. Richard D. Irwin, Inc., Homewood, Illinois, 1964.

Provides a concise historical survey of budgeting and budget simulation, a general (matrix) formulation of the budget simulation model, technical considerations referring to the implementation of budget simulation, and a discussion of possible improvements and extensions of the basic model.

518 Mayer, Sylvia R. HUMAN ENGINEERING IN THE DESIGN OF INSTRUCTIONAL SYSTEMS. Technical Documentary Report No. ESD-TDR-64-454, Decision Sciences Laboratory, Electronic Systems Division, L.G. Hanscom Field, Bedford, Massachusetts, September, 1964, 13pp.

519 Mead, Leonard C. SYNTHETIC TRAINING DEVICES. Prepared for the working group on Human Behavior under conditions of militate service. Department of Defense Research and Development Board. June 30, 1951.

This paper discusses synthetic training as it is now (1951) required as a supplement to and a substitute for conventional methods of military training. The learning of knowledge and skill by synthetic means is a military necessity for both operational and maintenance types of service jobs. Discussion centers around (1) psychological and military principles regarding the design, development and use of synthetic training devices; (2) reviewing and appraising these presently known principles; and (3) comparing these principles with current service policies and practices and recommending action of both an administrative and research nature so that the greatest value can be obtained from synthetic training devices.

520 Meier, R.L. EXPLORATIONS IN THE REALM OF ORGANIZATION THEORY. IV: THE SIMULATION OF SOCIAL ORGANIZATIONS. Behavioral Science, 6(3), 232-248, 1961.

This paper emphasizes synthesis of organization with a review of recent literature on simulation studies of social organizations. Simulations thus far have tended to concentrate on such things as management games and war games -- a narrow range considering the ultimate possibilities of their use in understanding behavior. What educational and training purposes can simulations be used for? How can we further expand this new method of studying social organizations?

521 Meier, Richard L. "GAME" PROCEDURE IN THE SIMULATION OF CITIES. In: The urban condition: People and policy in the metropolis, Leonard J. Duhl (Ed.), Basic Books. 348-354, 1963.

Up to now, cities have not been brought under simulation techniques. Current experience with the simulation of population ecology suggests that it is probably desirable to set up a family of simulations, the simplest of which is at the level of a parlor game, while the most advanced could well be used as a research tool. The outcome or result might be a graded series of simulations.

522 Meister, D. and D.E. Farr. THE UTILIZATION OF HUMAN FACTORS INFORMATION BY DESIGNERS. The Bunker-Ramo Corporation, Canoga Park, California, September 1966, 98pp. (AD 642 057).

The purpose of the report was to describe designer behavior in solving a series of specially developed design problems. Designer Behavior was analyzed in terms of the number of parameters the designer considered, the depth of his analysis, and the priority he placed on these parameters. Results indicate that designers generally have little or no interest in human factors as applied to design, nor do they use any available information. The analyses performed by the designers were primitive, considered few parameters, and were quite shallow in their analyses.

523 Meister, D. and D.E. Farr. THE UTILIZATION OF HUMAN FACTORS INFORMATION BY DESIGNERS. System Effectiveness Laboratory, The Bunker-Ramo Corporation, Canoga Park, California, for the Office of Naval Research, September 1966.

> Design engineers have little or no interest in human factors, human factors information, or in the application of human factors criteria to design. They do not possess or read human factors handbooks. Their attitude toward human factors is consistently negative in practice, although on a purely verbal basis they pretend to be quite positive. These are several findings made by Bunker-Ramo Corporation in a study of 20 design engineers to determine the use they made of human factors and other information in the solution of design problems, plus the analytic processes underlying their use of that information. The rationale for the study is that communication with the equipment designer has presented an urgent problem to the human factors specialist during much of the short history of this discipline.

524 Melaragno, R.J. A STUDY OF TWO METHODS FOR ADAPTING SELF-INSTRUCTIONAL MATERIALS TO INDIVIDUAL DIFFERENCES. System Development Corporation, (TM-2932/000/01), Santa Monica, California, for Office of Naval Research, June 1966.

> Two individual differences among learners have been compared with each other for effectiveness and with a third method in which there was only minimal adaptation to learners' individual differences. In this SDC study, the first adaptation procedure, referred to as the Branching condition, uses data from learner performance on the instructional materials as a basis for adjusting subsequent instruction to individual differences. The second, called the Prediction condition, uses data from learners' entry behavior, as measured by five tests administered prior to instruction, for predicting the best sequences of instructional materials for each learner individually. The third procedure, the Linear condition, provides only for individual differences in rate of learning by giving the identical instructional sequence to all learners. Results of the experiment indicate training times can be reduced by varying

instruction on the basis of learners' abilities; a branching strategy can reduce training time further than either prediction on linear strategies; and when both amount learned and training time are of interest, branching is superior to a linear presentation.

525 Melching, W.H. et al. DERIVING, SPECIFYING, AND USING INSTRUCTIONAL OBJECTIVES. Professional Paper 10-66, The George Washington University, Human Resources Research Office, Alexandria, Virginia, December 1966. (AD-644 976).

This paper presents a separate article from each author on some aspect of instructional objectives. Included are the general topics (1) defense of objectives, (2) ways objectives can vary, (3) content validity of objectives, and (4) objectives and measuring the success of instruction.

526 Melching, W.H. et al. A HANDBOOK FOR PROGRAMMERS OF AUTOMATED INSTRUCTION. U.S. Army Air Defense, Human Research Unit, Fort Bliss, September 1963.

The purpose of the handbook is to assist programmers and training supervisors by serving as a textbook and guide for new programmers and as a reference for the experienced programmer.

527 Miller, E.E. A CLASSIFICATION OF LEARNING TASKS IN CONVENTIONAL LANGUAGE. University of Illinois, Urbana, July 1963. 15pp. (AD 419 122).

"Learning Task" is defined for purposes of classification, and a descriptive system is introduced for analyzing training requirements and for relating various practice conditions. A logically exhaustive classification is presented. The restricted applicability of generalizations about learning to certain categories is discussed.

528 Miller, Ed Mack. THE DAY NORAD WENT TO WAR! Air Force, 93-95, August 1960.

A description of the day NORAD went to simulated war on June 8, 1960.

529 Miller, Gerald W. AN ATTEMPT TO DETERMINE CERTAIN EFFECTS OF LABORATORY CLASSROOM SIMULATION TRAINING ON SELECTED DIMENSIONS OF TEACHER BEHAVIOR. Unpublished Doctoral Dissertation, University of Oregon, August 1967.

Little evidence was gathered to distinguish between the simulation trained students and a control group on measures of teacher behavior in the classroom.

530 Miller, R.B. HANDBOOK ON TRAINING AND TRAINING EQUIPMENT DESIGN. WADC Technical Report 53-136, The American Institute for Research, Wright Air Development Center, Wright Patterson Air Force Base, Ohio, June 1953. 339pp.

The Handbook is intended to aid in preparing recommendations on the design and use of training equipment. It permits cross referencing to WADC Technical Report 53-138, Human Engineering Design Schedule for Training Equipment. These materials, in conjunction with WADC TR 53-137, A Method for Man-Machine Task Analysis, and WADC TR 53-135, A Method for Determining Human Engineering Design Requirements for Training Equipment, are designed for use by trained personnel.

531 Miller, R.B. PSYCHOLOGICAL CONSIDERATIONS IN THE DESIGN OF TRAINING EQUIPMENT. WADC Technical Report 54-563, The American Institute for Research, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, December 1954, 138pp.

The report presents a number of considerations and recommendations for trainer design under nine topic headings. The report is essentially a digest of previously published material by Miller and Swain and has been adapted for persons who may not have a professional background in Psychology. Topics are: (1) Some Principle Concepts in Learning and Transfer of Training, (2) Problems of Physical Simulation, (3) State of Learning and Degree of Physical Simulation, (4) Knowledge of Results and Scoring, (5) Recording procedures, (6) Proficiency Measurement, (7) The Design of the Instructor's Station, (8) The Trainer as Demonstrator of Principles, (9) Outline of Steps In Designing a Training Device.

532 Miller, R.B. TASK AND PART-TASK TRAINERS AND TRAINING. WADD Technical Report 60-469, The American Institute for Research, Wright Air Development Division, Wright-Patterson Air Force Base, Ohio, June 1960, 89pp. (AD 245 652).

Due to a lack of simulators to provide sufficient and varied practice in job skills, simpler devices are needed for training parts of tasks. Procedures for dividing total performance requirements into meaningful sub-tasks are described with risks of improper part task training and principles for reducing such risks also included.

533 Minas, J.S. _et al_. SOME DESCRIPTIVE ASPECTS OF TWO-PERSON NON-ZERO-SUM GAMES II _Journal of Conflict Resolutions_, 4, 193-197, 1960.

The games reported here required that each member of a pair of undergraduate Ss was to press either a red or a black button through a series of 30 trials. Each S was given a detailed explanation of the situation, the game contained no hidden information, and after each trial each S could determine which button the other had pressed by consulting the payoff matrix (representing pennies) pasted in front of him. Nevertheless, collaborative strategy was significantly avoided. "We can only conclude that performance in an iterated, two-person, non-zero-sum game ...is determined in good part by a maximization-of-difference principle that necessitates a competitive strategy."

534 Minsky, M. HEURISTIC ASPECTS OF THE ARTIFICIAL INTELLIGENCE PROBLEM. (Processed). Group Report No. 4-55, Massachusetts Institute of Technology, Cambridge, 1956.

535 Minsky, Marvin. A SELECTED DESCRIPTOR-ENDEXED BIBLIOGRAPHY TO THE LITERATURE ON ARTIFICIAL INTELLIGENCE. _Institute of Radio Engineers Transactions on Human Factors in Electronics_, HFE-2 (1), 39-55, 1961.

This listing is intended as an introduction to the literature on Artificial intelligence -- i.e. to the literature dealing with the problem of making machines behave intelligently. This bibliography presents some information about the literature to help those interested in this field of study locate reports on work already accomplished.

536 Minsky, M.L. STEPS TOWARD ARTIFICIAL INTELLIGENCE. Proceedings of IRE, 49, 8-30, January 1961.

In order to describe the logical advances in artificial intelligence and heuristic programming, author has divided the field into five areas: search, pattern-recognition, learning, planning and induction. The duality in the human self model may be a result of a lack of a satisfactory mechanical theory of mental activity, but it does not follow that a robot will suffer from the same lack. Any machine, programmed by man to behave intelligently, and equipped with self-awareness, will have the property that it will know exactly what it does (something we do not know), and it is possible to see some machine of the future eventually propounding an inverted Bishop Berkeley philosophy.

537 Mix, Dwight, F. LEARNING THEORY APPLIED TO COMMUNICATIONS. Dissertation Abstracts 27 (2-B), 480, 1966.

Computer simulation using Monte Carlo techniques is used to experimentally compare the convergence rates of five learning systems in both single threshold and two threshold binary decision-making models.

538 Moravec, A.F. DESIGNING THE INFORMATION SYSTEM BY SIMULATION. Paper presented at the thirteenth International Meeting of the Institute of Management Sciences, Philadelphia, Pennsylvania, September 6-8, 1966.

Successful information system simulation considers the differences in individual styles of management, requires management's full support, defines the goals at the start, develops a methodology along with the plan for implementation of the model, develops a basic decision-making logic, and consists of a manual model and simulator first then followed by a computer simulation. The probability of success of a simulation is increased through careful organization, high management involvement, orderly development, and pre-planned review and evaluation. (6 references)

539 Moravec, A.F. USING SIMULATION TO DESIGN A MANAGEMENT INFORMATION SYSTEM. Management Services, 3(3), 50-58,1966.

Simulation techniques are proposed as an alternative to both the usual experimental design of information systems and the complete mathematical model approach. (4 references)

540 Morgan, Thomas B. THE PEOPLE-MACHINE. Harper's 222 (1328), 53-57, 1961.

The model of an experimental airplane, when placed in a wind tunnel which simulates flight conditions, provides vital information about the future behavior of the actual plane without risking a test pilot's life. This article asks whether something akin to this can be done where people are concerned. Can a "people-machine" be built that could simulate future human behavior?

541 Morgenthaler, G.W. THE THEORY AND APPLICATION OF SIMULATION IN OPERATIONS RESEARCH. In: Progress in Operation Research, R.L. Ackoff, (Ed.). Wiley, 1, 363-420, 1961.

This chapter outlines a definition of terms relating to simulation, examination of existing theory, indication of strengths and weaknesses, and a study of recent applications. Extensive bibliography, 413-419.

542 Moshman, J. SIMULATION IN OPERATIONS RESEARCH. Science in Management. Proceedings of the 1959 Conference of the Administrative Applications Division, American Society for Quality Control, Washington D.C., March 1959.

543 Moss, J.H. COMMENTARY ON HARLING'S "SIMULATION TECHNIQUES IN OPERATIONS RESEARCH." OR JORSA, 6, 4, July-August 1958.

544 Muckler, F.A. *et al*. PSYCHOLOGICAL VARIABLES IN THE DESIGN OF FLIGHT SIMULATORS FOR TRAINING. WADC Technical Report 56-369, Aviation Psychology Laboratory, University of Illinois, Urbana, January 1959. 132 pp. (AD 97130).

In the design, construction and use of flight simulators and trainers, two problem areas have been contrasted frequently. The first concerns the degree of fidelity of physical simulation that may be achieved between training device and operational aircraft. The second is termed the problem of psychological simulation, i.e., the training value that results from use of a synthetic training device -- fundamentally a psychological problem of transfer of training from the device to the aircraft. A survey of many of the problems that have arisen in the context of psychological simulation is included. Existing training research literature on flight trainers and simulators is evaluated; and a number of experimental programs are suggested. Several specific problem areas concerning design and use of flight training devices have continually appeared and these areas have been examined briefly, with particular emphasis on possible empirical solutions. In addition, motivational, instructional, and methodological variables are considered. Finally, conventional theories of transfer of training are evaluated in terms of their predictive efficacy in the area of fidelity of psychological simulation.

545 Muckler, F.A. et al. TRANSFER OF TRAINING WITH SIMULATED AIRCRAFT DYNAMICS: I. VARIATIONS IN PERIOD AND DAMPING OF THE PHYGOID RESPONSE. USAF WADD Technical Report, No. 60-615 (Pt 1), vi, 1961, 44pp.

This report is the first in a series of experiments dealing with transfer of training as a function of variations in simulated aircraft longitudinal dynamics. Ss performed single-dimension compensatory tracking with an apparatus using long-period oscillatory transients (the phygoid response) as control system dynamics. Two experiments are discussed: (a) period and damping variations of the phygoid response and (b) pilot and nonpilot performance with a very long period, poorly damped transient. (25 references)

546 Munger, M.R. IDENTIFICATION AND ANALYSIS OF PERSONNEL FUNCTIONS in J.D. Folley (Ed.), Human Factor Methods for System Design. American Institute for Research, Pittsburgh, Pennsylvania, AIR-290-60-FR-225, Contract Nonr 2700(00), Chapter 2, 21-42, 1960.

"Identification and analysis of performance requirements is central to an effective human factors program. It is the ... link between equipment design and the ... personnel who will use the equipment."

The technique can be applied in three phases. The first phase is function allocation. The second phase follows when a tentative design configuration has been agreed upon. The third phase is accomplished progressively throughout system development as performance requirements become available.

"The process of function allocation consists of three major steps: (1) Determination of system requirements, (2) System function analysis, and (3) Assignment of functions to man and equipment."

Requirements that the final system is expected to meet are 'givens' in function allocation. ... Proceeding from system requirements to system functions is a process of successive approximation."

547 Muses, C.A. (Ed). ASPECTS OF THE THEORY OF ARTIFICIAL INTELLIGENCE. The Proceedings of the First International Symposium on Bio-simulation, 1960, Plenum Press, New York, 1962.

548 Muses, C.A. THE LOGIC OF BIOSIMULATION. In: Aspects of the theory of artificial intelligence. The Proceedings of the First International Symposium on Bio-simulation, 1960, Plenum Press, New York, 115-163, 1962.

Biosimulation is a word coined by Muses in February of 1960. By it he meant the imitation or simulation by man of the behavior and functioning of living things, such simulation being effected through man-made devices, i.e., machines in the broadest sense.

549 Myers, L.B., R.G. Carter, and R.S. Hosteller. GUIDEBOOK FOR THE COLLECTION OF HUMAN FACTORS DATA. State College, HRB-Singer, Inc., Pennsylvania, Report No. PTB 66-3, January 1966, Contract Nonr-4751(00), (Ad 631 023).

"This guidebook was developed primarily as a reference to aid the Project Officer in the assessment of human factors effects on system performance and in the isolation of the causal factors. There are three sections to this guidebook, each serving a different purpose. Section I provides the necessary background information and sets the perspective for the use of the techniques and materials presented in

Section II. This section contains the tools for obtaining time, accuracy, and maintenance data as well as the techniques for analyzing and interpreting these data. Methods for obtaining qualitative data through questionnaires and checklists are also contained in this section, including sample questionnaires and checklists. The third section (Section III) contains a fairly detailed example of the application of the previously described techniques. Also included are rather complete lists of test objectives and criteria measures."

550 Nachtigal, Paul. A COMPUTERIZED APPROACH TO THE INDIVIDUALIZING OF INSTRUCTIONAL EXPERIENCES. Boulder Valley School District Re 2 (Colorado), Planning phase report, U.S. Office of Education Grant Number OEG 4-6-000481-0414.

A conceptual model is presented which will (1) accomodate the Teaching-Learning Environment and the individual learner and the interactions between the two which constitute the teaching-learning process, and (2) allow the use of the computer to assist with the decision making process of the instructional program.

551 Naylor, T.H. and D.T. Gianturco. COMPUTER SIMULATION IN PSYCHIATRY. Archives of General Psychiatry, 15(3), 293-300, 1966.

Presents an outline of the methods and procedures involved in planning computer simulation experiments. It is suggested that this technique enables psychiatric researchers to perform controlled, laboratory-like experiments using an electronic computer. Computer simulation experiments are defined in terms of: problem formulation, data collection, model formulation, parameter estimation, evaluation of the model and parameter estimates, formulation of a computer program, validation, experimental design, and analysis of simulated data.

552 Nelson, H. Wayne. SIMULATION. Data Processing, 8, 60-93, 1966.

This article is an introduction to simulation and its uses, oriented toward management.

553 Newell, Allan and Herbert A. Simon. COMPUTER SIMULATION OF HUMAN THINKING. Science, 134(3495), 2011-2017, 1961.

A theory of problem solving expressed as a computer program permits simulation of thinking processes.

554 Newell, Allan and Herbert A. Simon. COMPUTER SIMULATION OF HUMAN THINKING AND PROBLEM SOLVING. Datamation, 7(6), 18-20. (Reprinted in Computers and Automation 10: 18-19 ff, 1961; also reprinted in Management and the computer of the future, M. Greenberger, (Ed.). Wiley, New York, 1962.)

This paper inquires as to what we have learned about human thinking and problem solving through computer simulation, and to what extent we now have theories for these phenomena, and what the content of these theories is.

555 Newell, Allan and Herbert A. Simon. GPS, A PROGRAM THAT SIMULATES HUMAN THOUGHT. In: Computers and thought, E.A. Feigenbaum and J. Feldman, (Eds.) McGraw-Hill. 279-293, 1963.

556 Newell, Allan and Herbert A. Simon. THE SIMULATION OF HUMAN THINKING. In: Current trends in psychology, 1959. University of Pittsburgh Press, Pittsburgh, Pennsylvania, 1960.

557 Newell, Allan and Herbert A. Simon. THE SIMULATION OF HUMAN THOUGHT. In: Current trends in psychological theory. University of Pittsburgh Press, 152, 1961. (Originally printed as Rand Corporation Paper P 1734, 1959).

"There is now substantial evidence that a digital computer, appropriately programmed, can carry out complex patterns of processes that parallel exceedingly closely the processes observable in human subjects who are thinking" . . . the significance of the computer is not solely in its ability to exhibit humanoid behavior. . . a program can be written which constitutes a theory of the computer's behavior in literally the same sense that tne equations of Newtonian dynamics constitute a theory of the motions of the solar system. . . "Thinking is to be explained by writing a program for a thinking process."

558 Newman, C. and Leonard Uhr. BOGART: A DISCOVERY AND INDUCTION PROGRAM FOR GAMES. Proceedings of the Association for Computing Machinery 20th National Conference, Cleveland, Ohio, August 1965. 176-186, 1965.

This paper describes the general philosophy behind a set of board game playing routines which are capable of learning to play board games such as Tic-Tac-Toe, hexapawn, and GOMOKU. The object of this paper was to illustrate that it is possible to solve a large class of dissimilar problems by the use of learning techniques.

559 Nichols, W.H. and H.S. Packard (Eds.) TRAINING AIDS IN SSTP. Technical Memorandum, TM-135, System Development Corporation, Santa Monica, California, March 1959.

Standard SSTP Training Aids used in conducting SSTM's at the Direction Center level.

560 Nilsson, Nils J. LEARNING MACHINES. McGraw-Hill, 1965.

This work deals specifically with the theory of a subclass of learning machines, those which can be trained to recognize patterns.

561 Nissenson, J. (ed). COMPUTER SCIENCE RESEARCH REVIEW. Carnegie Institute of Technology, for the Advanced Research Projects Agency, 1966.

Annual Report in selected essay form of highlights in research in information processing for 1966 at CIT.

562 Noel, R. C. THEORY AND PROCEDURE FOR A SIMULATION OF INTERNATIONAL RELATIONS. Prentice-Hall, 1963

563 Noll, A.H. et al. SIMULATION, KEY TO SYSTEM DEVELOPMENT. S.A.E. Journal, 65, November 1957

564 Ockerman, D. LaM. COMPUTER SIMULATION OF VISUAL DATA PROCESSING IN THE HUMAN BRAIN. Report No. GGC/EE/65-10, Air Force Institute of Technology, 1965.

The operation of the visual portion of the human brain has been simulated on the IBM-1620 and IBM-7094 digital computers. The simulation was designed using the cross-correlation method postulated by Dr. Kabrisky. The simulation is very coarse as the grain size of the visual area of the human brain is 400 times finer than the computer model. The model stores new patterns, standardizes pattern sizes, rotates the input pattern and recognizes identical or similar patterns. The model is evaluated by inserting 20 test patterns. The model did seem to simulate the human visual recognition system for these input patterns.

565 Ohm, Robert E. A GAME THEORY DERIVED RATIONALE FOR CONSTRUCTING FEEDBACK TO IN-BASKET ITEMS USED IN THE MADISON SCHOOL SYSTEM SIMULATION. Mimeograph paper, University of Oklahoma, Norman, 1967.

The rationale presented was designed to help users of the Madison Simulation construct feedback material to student responses to the initiating in-basket items used in the exercise. A sample application, the Leadership Game, is included as a demonstration.

566 Ohio State University, LABORATORY OF AVIATION PSYCHOLOGY. Symposium: The theoretical aspects of research on man-machine systems, May 7-8, 1957.

567 O'Neill, R.R. SIMULATION OF CARGO HANDLING. In: Report of System Simulation Symposium, American Institute of Industrial Engineers. Waverly Press, Baltimore, 35-41, 1958.

The subject of this paper is the simulation of the movement of cargo from the place of final rest on the pier to the secured position in the cargo hold of the vessel in order to predict longshore loading productivity: i.e., the average rate of flow expressed in tons per hour. First, however, a brief description of the overall system is given.

568 Orcutt, G.H. SIMULATION OF ECONOMIC SYSTEMS. American Economic Review, 50(5), 893-907, 1960.

Economic systems are complex organizations involving the behavior of hundreds of millions of complicated decision units and their interaction. This paper disucsses the various means by which satisfactory computer simulation of large-scale systems can be made feasible.

569 Orcutt, G.H. et al. MICROANALYSIS OF SOCIO-ECONOMIC SYSTEMS: A SIMULATION STUDY. Harper, 1964.

The design of a highly complex stochastic model of a population, participation of its members in the labor force, and some of their budget decisions, using large numbers of representative persons to avoid errors of aggregation. Examples of projection by simulation given. Also included are discussions of general approach, computer procedure, and future prospects.

570 Osborn, W.C. and Barbara E. Goodman. A TENTATIVE ORGANIZATIONAL SCHEMA FOR DECISION-MAKING PROBLEMS. The George Washington University, Human Resources Research Office, Technical Report 66-14, Alexandria, Virginia, July 1966. 26pp.

To take into account the psychological complexity of most real-life decision problems, and to develop a tentative organization of decision behavior that will embrace the many, highly diverse types of problems which are presumed to result in "decision," an attempt was made to delineate the component response processes that lead to these decisions. The procedure followed was (a) to identify and descriptively define the relevant stimulus and organismic factors, and (b) especially to schematize the response dimensions involved, in such a way as to derive a tentative response matrix. The result is an organizational schema for use in analyzing the response aspects of the decision-making process in terms of the pertinent psychological dimensions of decision behavior.

571 Ozkaptan, H. and R. Gettig. COMPUTER SIMULATION OF MAN-INTEGRATED SYSTEMS. Behavioral Science, 8 (3), 259-266, 1963.

A description of a model which delineates the optimum design utilization of man-machine resources relative to desired system criteria. This includes the allocation of human and equipment resources to system requirements and the simulation of the system throughout its mission for purposes of evalutaion.

572 Parker, J.F., Jr. and Judith E. Downs. SELECTION OF TRAINING MEDIA. ASD Technical Report 61-473, Psychological Research Associates, Matrix, Corporation, Arlington, Virginia, September 1961.

> The report is "designed to assist a training analyst faced with the problem of selecting specific training aids and devices to be used in support of the development of the personnel subsystem of a military system."

573 Pask, Gordon, THE SIMULATION OF LEARNING AND DECISION-MAKING BEHAVIOR. In: Aspects of the theory of artificial intelligence. The Proceedings of the First International Symposium on Biosimulation, Locarno, June 29-July 5, 1960, C.A. Muses, (Ed.). Plenum Press, 1962.

> This paper examines the peculiar difficulties of simulating the learning behavior of man, certain animals, and those mechanical artifacts in which forms of organization evolve.

574 Pask, Gordon. THE TEACHING MACHINE AS A CONTROL MECHANISM. Journal of Social Instrument Technology, June 1960.

575 Peters, G.A. and F.S. Hall. SOURCES OF INFORMATION IN HUMAN FACTORS ENGINEERING, INCLUDING ASSOCIATED AREAS IN SYSTEM SAFETY, MAINTAINABILITY, PERSONNEL SUBSYSTEM, LIFE SCIENCES, QUALITY ASSURANCE, AND RELIABILITY ENGINEERING. Rocketdyne, Canoga Park, California, N64-18490, January 1964.

> "A comprehensive listing of regulatory and guidance documents pertaining to human-factors engineering and to areas of technical overlap or interdependence is presented. The references are divided into the following groups: (1) regulatory and guidance documents - a listing of documents that specified what should be done by human factors activities, including various regulations, specifications, standards, manuals, instructions, and programs requirements that attempt to define the character of the contractors human-factors function; (2) descriptive publications - a sampling of government agency reports that attempt to describe how various functions might be accomplished, review the state of the art in a given area, present new methods, or list basic data that might be useful in human factors analysis."

576 Pickrel, E.W. and T.A. McDonald. QUANTIFICATION OF HUMAN PERFORMANCE IN LARGE COMPLEX SYSTEMS. Human Factors, 6 (6), 647-662, December 1964.

> "...human failures are responsible for a large share of all system degradation. The probable sources of human errors must be identified and eliminated when their potential effect on system degradation is great. ... elimination should be accomplished early in system development so costs can be minimized and production schedules maintained. ... concentrate efforts for failure reduction on those errors ... most likely to occur and most likely to have severe effects. ... severity of the effects must be ... quantified. ... [the] probable frequency of effects and the severity of the effects of a given error to be represented by a single numeral. Then a criticality index may be established as an objective tool for making necessary trade-off decisions. ...alternatives may be selected which are least likely to encourage the occurrence of human error or result in critical system degradation. ... a quantitative approach to the 'human-in-the-system' performance problem is far more efficient and effective than an approach which makes no attempt to quantify human failures and their related effects.

577 Pierce, A.M. A CONCISE BIBLIOGRAPHY OF THE LITERATURE ON ARTIFICIAL INTELLIGENCE. Air Force Cambridge Research Center, Electronics Research Division, AFCRC-TN-59-773, Bedford, Massachusetts, September 1959,

> This bibliography is a bare listing of the literature on "artificial intelligence" as the term applies to systems whose operating behavior would be called "intelligence" if exhibited by man. Unindexed, it has a minimum of cross references to related subjects, most references to physiology, psychology, logic, automata theory, decision theory, theory of games, and even neural net theory, having been omitted. (243 references.)

578 Poe, Arthur C., Jr., Major O.B. Jolley, and W.W. Prophet. INTACT: INTEGRATED INSTRUMENT CONTACT PRIMARY FLIGHT TRAINING. U.S. Army Aviation Digest, 6(7), 10-11, 1960.

A description of Task INTACT: the purpose of this task is to compare the effectiveness of integrated instrument/contact flight training with current training in the Army Aviation Primary Fixed Wing Flight Training Program.

579 Pool, Ithiel de Sola. SIMULATING SOCIAL SYSTEMS. International Science and Technology, 62-70, March 1964.

Predicting results in any complex sytem requires accounting for individual human behavior. Using "engineering" maxims about peoples' responses -- and computers -- the social sciences now "can do".

580 Pool, Ithiel de Sola and Robert Abelson. THE SIMULATICS PROJECT. Public Opinion Quarterly, 25, 167-183, 1961. Also, In: Simulation in Social Science: Readings, Harold Guetzkow, (Ed.), Prentice-Hall, 70-81, 1962.

This is the first report on a program of research conducted for the Democratic Party during the 1960 campaign. The research used a new technique for processing poll data and included computer simulation of likely voter behavior. The immediate goal of the project was to estimate rapidly, during the campaign, the probably impact upon the public, and upon small strategically important groups within the public, of different issues which might arise or which might be used by the candidates.

581 Pool, Ithiel de Sola, Robert P. Abelson, and Samuel L. Popkin. CANDIDATES, ISSUES, AND STRATEGIES: A COMPUTER SIMULATION OF THE 1960 PRESIDENTIAL ELECTION. Massachusetts Institute of Technology Press, Cambridge, 1964.

A report of the first use of computer simulation as a social research technique. The simulation, done for the Democratic Party, processed public opinion poll data and provided a field test of some theories of opinion formation. This book gives a detailed account of the Simulmatics Project.

582 Porter, Elias. MANPOWER DEVELOPMENT: THE SYSTEM TRAINING CONCEPT. Harper and Row, 1964. (138pp.).

This book delineates how man-machine systems operate, provides some uses of simulation in man-machine systmes, and describes the procedure used in de-briefing.

583 Potter, D., J.J. Moss, and H.F.A. Smith. PHOTOSITUATIONS-A TECHNIQUE FOR TEACHING. Burgess Publishing Company, Minneapolis, 1963.

Presents 24 pictures which seem to be teacher-training oriented but which, the authors say, may be of interest to other areas concerned with human interaction. Along with each picture are questions designed to elicit certain prinicples that pertain to the teacher.

584 Potts, T.F., G.N. Ornstein, and A.B. Clymer. THE AUTOMATIC DETERMINATION OF HUMAN AND OTHER SYSTEM PARAMETERS. Proceedings of the Western Joint Computer Conference, 1961. Western Joint Computer Conference, Los Angeles, California, 645-660, 1961.

Automatic computer methods for the determination of system parameters from dynamic test data are reviewed and compared.
There is a discussion of a broad range of potential applications of methods for determination of the parameter values required for computer simulation of human systems, other biological systems, socioeconomic systems, and physical systems of concern in science and engineering.

585 Project SIMILE staff, (Eds.). OCCASIONAL NEWSLETTER ABOUT USES OF SIMULATIONS AND GAMES FOR EDUCATION AND TRAINING. Western Behavioral Sciences Institute, LaJolla, California, 1, September 1965.

The newsletter provides information about many people working with and projects which utilize games or simulations in education or training.

586 Prophet, W.W. THE IMPORTANCE OF TRAINING REQUIREMENTS INFORMATION IN THE DESIGN AND USE OF AVIATION TRAINING DEVICES. Professional paper 8-66, The George Washington University, HumRRO, Alexandria, Virginia, December 1966.

Gives sequence of procedures by means of which devices and training programs should come into existence. Examples from HumRRO Division No. 6 are used as illustrations.

587 Prophet, Wallace W. HELICOPTER FORMATION FLYING. U.S. Army Aviation Digest, 9(2), 11-14, February 1963.

A discussion of the Human Factors approach to pilot training and proficiency in helicopter formation flying.

588 Prophet, Wallace W. PRESENT AND FUTURE USES OF TRAINING DEVICES IN ARMY AVIATION. U.S. Army Aviation Human Research Unit, Fort Rucker, Alabama, 1962.

A discussion of devices used primarily in teaching operator skills necessary to or associated with the piloting of Army aircraft by the Army aviator.

589 Quant, Richard E. ON THE USE OF GAME MODELS IN THEORIES OF INTERNATIONAL RELATIONS. In: The international system, theoretical essays, Klaus Knorr and Sidney Verba (Eds.). Princeton University Press, Princeton, New Jersey, 69-76, 1961.

Typologies of game models in international relations, difficulties of using game models in international relations, and, metamodels and reality, are some of the topics discussed in this paper.

590 Raia, Anthony P. A STUDY OF THE EDUCATIONAL VALUE OF MANAGEMENT GAMES. *The Journal of Business*, 39(3), 339-352, July 1966.

College seniors in a business policy course were assigned to experimental and control groups to evaluate the experimental contribution of participation in business games. The games were found to increase student learning, motivation, and interest. No difference was found between students in the simple and the complex management game, nor did students who participated in the games have a more favorable attitude toward the course.

591 RAND Corporation, Social Science Division. EXPERIMENTAL RESEARCH ON POLITICAL GAMING. RAND Corporation, RAND Report, P-1540-RC, Santa Monica, California, November 10, 1958.

592 Rapoport, A. CRITIQUES OF GAME THOERY. *Behavioral Scientist*, 4, 49-66, 1959.

The theory of games has initiated a new mathematical approach to behavioral science, based on conceptualizations entirely absent in "classical" applied mathematics. In the wake of the first formulation of the theory came a proliferation of new avenues of attack on age-old problems involving situations of interest conflict, cooperation, bargaining, and power play. The liveliness of the subject is attested by the vigor of controversy about its very foundations.

593 Rapoport, Anatol. EXPLOITER, LEADER, HERO, AND MARTYR: THE FOUR ARCHETYPES OF THE 2 X 2 GAME. *Behavioral Sciene*, 12(2), 81-84, 1967.

Further delineation of the possibilities of the 2x2 game, as put forth by one of the leaders in the field.

594 Rapoport, A. FIGHTS, GAMES AND DEBATES. University of Michigan Press, Ann Arbor, Michigan, 1960.

Three modes of conflict are identified and the "diferent kinds of intellectual tools for analysis of conflict situations" are examinated. Part I is given "to some mathematical models of mass conflict and their ramifications. . .Part II is derived entirely from the ideas of game theory and related areas (Mathematical theories of the decision process)" Part III deals with debates, "Struggles deriving from the clashes of outlooks."

595 Rapoport, Anatol. MODELS FOR PRISONER'S DILEMMA. Journal of Mathematical Psychology, 3(2), 269-286, 1966.

Five models of behavior in the Prisoner's Dilemma are evaluated with respect to two sets of data. Three of the models are relatively adequate in accounting for the observed time courses of outcomes, but are further differentiated by the variances. The "best-fitting" parameters for each model are used to suggest psychological hypotheses about the gross differences observed between male and female populations. The basic methodological problem remains of choosing a model which is accurate enough and at the same time both mathematically tractable and suggestive.

596 Rapoport, Anatol. STRATEGY AND CONSCIENCE. Harper and Row, 41-57 and 125-159, 1964.

This book is a critique of rational decision theory, and of the application of it to military problems. The hypothesis of the book is that "strategic thinking" is based on game theory, an hypothesis which has been challenged by economists.

597 Rapoport, Anatol, and Albert M. Chammah. THE GAME OF CHICKEN. American Behavioral Scientist, 10(2), 10-28, Part II, 1966.

Behavior in a game simulating brinksmanship and appeasement is analyzed as a function of varying parameters in the game and as over-time trends.

598 Rapoport, Anatol and Melvin Guyer. A TAXONOMY OF 2 X 2 GAMES. In: General Systems: Yearbook of the Society for General Systems Research, 11, Ludwig von Bertalanffy and Anatol Rapoport, (Eds.). Published by the Society, Bedford, Massachusetts, 203-214, 1966.

A delineation of games which are of theoretical interest for use in examination of conflict resolution and related behaviors in man.

599 Rapoport, A. and Carol Orwant. EXPERIMENTAL GAMES: A REVIEW. Behavioral Science, 7(1), 1-37, January 1962

A review of research into game theory and decision making. The review considers both 2- and n-person games, zero-sum and non-zero-sum games, games where payoffs are known and unknown, and simulatons which involve games. A glossary is appended.

600 Rapoport, A., *et al*. THREE PERSON NON-ZERO-SUM NON-NEGOTIABLE GAMES. Behavioral Science 7(1), 38-58, 1962.

Four experiments are reported in each of which three persons participated. Communication among the parties was, in general, impossible. The findings are analyzed, and a mathematical model is proposed which is relatively effective in predicting the gross percentage of cooperative behavior in each game. The differing personalities of the players significantly affected their selections of strategies.

601 Rawdon, R. H. LEARNING MANAGEMENT SKILLS FROM SIMULATION GAMING. Bureau of Indestrial Relations, University of Michigan, Ann Arbor, Michigan, 1960.

A discussion of various training techniques used by industry to try to help people learn to make decisions; management gaming or simulation seems to overcome most of the limitations which apply to other techniques formerly used.

602 Redgrave, M.J. SOME APPROACHES TO SIMULATION, MODELING, AND GAMING AT SYSTEM DEVELOPMENT CORPORATION. SP-721, System Development Corporation, Santa Monica, March 1962.

Results of the Washington Division Seminars held 19-21 July at Falls Church, Virginia, are presented. The general feeling of the participants was that modeling and simulation should not be considered as separate disciplines because they rely so heavily on contributions not only from the sciences but from the liberal arts. Modeling and simulation are useful tools for scientific inquiry, but should be used judiciously and their predictive qualities applied with knowledgeable caution. Many times a problem can be solved without resort to a computerized simulation. It was suggested that a policy be established to encourage the customer to buy a feasibility study prior to deciding to have such a simulation. The problem may be ill-defined and to rush blindly into a computer simulation may well prove unfortunate.

603 Reed, L.R. A STUDY OF THE FEASIBILITY OF USING OPERATIONAL SIMULATION TECHNIQUES FOR EVALUATING ADMINISTRATIVE SKILLS POSSESSED BY INSTRUCTIONAL COMMUNICATIONS SPECIALIST. Syracuse University, Syracuse, Unpublished Ph.D. Dissertation, 1966.

Purpose of the study was to determine the feasibility using operational simulation techniques to establish criteria for the evaluation of administrative skills in instructional communications specialists and to design materials to demonstrate these skills. Differences in the individual scores between the test and normative groups indicate that the materials discriminate both individuals and groups. Concludes that materials can be used to compare individuals to the normative group, and that an effective scoring system has been developed for this comparison.

604 Reed, Ruddell, Jr. SIMULATION BY MONTE CARLO. Tappi, 49(1), 28-32, January 1966.

Engineers have always used simulation in one form or another to study alternate designs and operating characteristics. By doing so, they are able to discover faults in the design and prevent costly errors. Monte Carlo simulation is the latest of these techniques. While it does not eliminate design problems, it does permit a better estimate of what can be expected of a system design.

605 Reich, J.E. and J.J. Perez. DESIGN AND DEVELOPMENT OF A SAMPLED-DATA SIMULATOR. In: Proceedings of the Western Joint Computer Conference, papers presented at the Joint IRE-AIEE-ACM Computer Conference, Los Angeles, California, May 9-11, 1961. National Joint Computer Committee, 341-351, 1961.

This paper describes the design and development of a sampled-data simulator (a special purpose analog computer) constructed recently at Space Technology Laboratories, Inc. (STL). The device was developed to simulate missile and spacecraft control system problems containing both continuous and sampled information. The machine has increased the speed of simulation, and decreased costs of operation.

606 Reiss, R. THE DIGITAL SIMULATION OF NEUROMUSCULAR ORGANISMS. General Precision, Inc., Librascope Division, The Laboratory for Automata Research, Monograph 60-2, February 1960.

607 Reitman, Walter R. HEURISTIC PROGRAMS, COMPUTER SIMULATION AND HIGHER MENTAL PROCESS. Behavioral Science, 4(4), 330-335, 1959.

A discussion of how the synthesis of intelligent systems on digital computers makes possible new fundamental research into higher mental processes underlying human intellectual, adaptive, and creative activity. This paper examines the methodological basis for such research.

608 Reitman, W.R. PROGRAMMING INTELLIGENT PROBLEM SOLVERS. IRE Transactions on Human Factors in Electronics, HFE-2(1), 26-33, 1961.

A report of research programs under development are discussed as illustrations of the evolution of heuristic programming systems. Methods and goals of techniques used in studies of problem-solving in mathematics, symbolic logic, industry and business, chess playing, are considered.

609 Research Analysis Corporation. COMPUTER-AIDED INFORMATION SYSTEMS FOR GAMING. Research Analysis Corporation, McLean, Virginia, for the Army, September 1964.

Shows how war operations and business activities of industrial operations can be simulated with the aid of the computer. From the information point of view, these games may be divided into three types -- computer simulations, digital man-machine games, and continuous variable man-machine games. Computer simulations are completely automated games and are always rigid, whereas the other two use people for decision making. Special developments in gaming include the use of systems of games with outputs of one employed as inputs of another, the use of heuristic problem-solving techniques in games, and the development of specialized computer hardware and software for gaming purposes. The review contains an extensive bibliography directing the reader to more specialized papers.

610 Ricciardi, Franc M. TOP MANAGEMENT DECISION-MAKING SIMULATION. In: Report of System Simulation Symposium. American Institute of Industrial Engineers, 42-46, 1958.

A description of an original new approach to the problem of simulating the decision making process, the Top Management Decision Gaming, a training device just developed by the American Management Association.

611 Rice, A.H. EDUCATORS WILL HEAR A LOT ABOUT SIMULATION TECHNIQUES. Nation's Schools, 78, 10+, October 1966.

612 Rice, S.H. SIMULATION IS BIG WORD IN ADMINISTRATIVE TRAINING. Nation's Schools, 73, 10, 1964.

Research in school administration is beginning to demonstrate that it can be practical. One of the techniques examined here is simulation in relation to educational research.

613 Rich, R.P. SIMULATION AS AN AID IN MODEL BUILDING. In: Simulation in Social Science: Readings. Harold Guetzkow, (Ed.) Prentice-Hall, 166-171, 1962. Reprinted from Operations Research, 3, 15-19, 1955.

This paper attempts to show one way in which the task of model building can be made easier. A specific example is described in which an illustration of the use of a device which simulates the physical situation to be analyzed is given.

614 Richards, P.I. ON GAME LEARNING MACHINES. Scientific Monthly, 74, 201-205, April 1952.

"Can one conceive of a machine that has absolutely no built-in knowledge but does have an 'intelligent' ability to learn almost any game through experience alone?" A list of suggestions for the design of such a machine are presented, with likely imperfections and analogies in human behavior pointed out.

615 Richards, W.T. SIMULATION: WHAT IS IT AND WHAT DOES IT OFFER? Wisconsin Journal of Education, 96, 12-13, April 1964.

616 Riley, Vera and J.P. Young. BIBLIOGRAPHY ON WAR GAMING. Processed. The Johns Hopkins University, Chevy Chase, April 1, 1957.

617 Rivett, B.H.P. THE APPRECIATION OF OPERATIONAL RESEARCH THROUGH A MANAGEMENT EXERCISE. Proc., 6th International Meeting Institute of Management Science, Paris, September 7-11, 1959, 1, 241-249, 1961.

A management game, cast in terms of the coal industry in Britain, which is solvable by classic operational research techniques, is described. The game, known as Promax, is intended for use in management training programs as an introduction to operational research.

618 Roberts, Edward B. INDUSTRIAL DYNAMICS AND THE DESIGN OF MANAGEMENT CONTROL SYSTEMS. In: Management Controls: new directions in basic research, 102-126. Bonni, Charles P., Robert K. Jaedicke and Harvey J. Wagner, (Eds.) McGraw-Hill, 1964.

As the title implies, problems in management science are viewed as problems in control. Recognition of feedback loops, whether they involve information, materials, or decisions is of the essence. When feedback loops are present, but are ignored by the management analyst, unhappy results may follow. The case of the Sprague Electric Company is cited, in which an analysis regarding demand as a random variable of classical statistics theory failed to solve the problem of fluctuating inventory. When recognition was given to the fact that the customer had its own analysts and was reacting "intelligently," rather than randomly, a feedback loop was discovered to exist; and this feedback loop was causing resonance.
The author reports on simulation model studies in which similarly subtle feedback effects act perversely in such diverse areas as attempts at "speed-ups" in production, management of research and development projects, and in quality control systems. Once the

proper diagnosis is made, i.e., recognition of a feedback loop causing resonance, the corrective action is often evident.
In the last few pages of the paper several sentences were, unhappily, set in italics. For example: "Control systems for R and D which resort to schedule and effort rate control without full understanding of the system structure of projects are bound to be effective." Further on: "The man (and manager) is part of the system of control, and management control system design must be viewed as a form of man-machine system design." The reader trying to decide whether or not to invest his time in reading the paper, and who not unreasonably, concludes that the author must feel that these are the important results of his research, may well decide that the paper could not contain anything of interest. In this, he will be mistaken.
Discussions of this paper, and others, by Conway, Hoggatt and Sprawls appear on pp. 140-148 of the same volume [CR Rev. 7526].

A.C.Williams, Princeton, New Jersey

619 Robin, E.A., et al. A COMPUTER DRIVEN SIMULATION ENVIRONMENT FOR AIR TRAFFIC CONTROL STUDIES. Fall Joint Computer Conference, AFIPS Conference Proceedings, 24, 437-442, 1963.

A description of the use of programed digital aircraft simulators; their success was at least partly measured by the fact that with the digital simulators there was never any problem of drift or alignment that were present in the analog simulators.

620 Robinson, J.A. SIMULATION AND GAMES. Department of Political Science, Ohio State University, Columbus, Ohio, Unpublished paper, 1965.

621 Robinson, James A., et al. TEACHING WITH INTER-NATION SIMULATION AND CASE STUDIES. The American Political Science Review, 60, 53-66, 1966.

"Simulation" and "case studies" are supplementary teaching aids available for university courses in political science and international relations. The newer technique, simulation, has been used at several universities to augment instruction in international relations, foreign policy making, national security policy, urban politics, and political parties and elections.

622 Robinson, Patrick J. CASES IN SIMULATION: A RESEARCH AID AS A MANAGEMENT "DEMONSTRATION PIECE". In: Report of System Simulation Symposium. American Institute of Industrial Engineers, 47-58, 1958.

Simulation as a technique for gaining knowledge in advance about the probable behavior of a business operation or competitive system before actually starting it.

623 Robinson, Patrick J. SYSTEM SIMULATION HELPS SOLVE COMPLEX OPERATIONS. Society of Automotive Engineers Journal, 66(2), 88-89, 1958.

A report of a talk given by Robinson at the SAE Montreal section in which he outlines the varieties of ways in which simulation can be used for training purposes, for basic experimentation, and in the evaluation of various problems.

624 Roeckelein, J.E. SIMULATION OF ORGANIZATIONS: AN ANNOTATED BIBLIOGRAPHY. HumRRO, Division No. 4, Infantry, March 1967.

625 Rome, B.K. and S.C. Rome. LEVIATHAN: A SIMULATION OF BEHAVIORAL SYSTEMS, TO OPERATE DYNAMICALLY ON A DIGITAL COMPUTER. International Conference for Standards on a Common Language for Machine Searching and Translation, Cleveland, 1959.

626 Rome, S.C. A PROPOSAL TO SIMULATE A MAN-MACHINE SYSTEM ON A DIGITAL COMPUTER, SD-3142, System Development Corporation, Santa Monica, California, 1959.

627 Rook, L.W., Jr. MOTIVATION AND HUMAN ERROR. Sandia Corporation, Albuquerque, New Mexico, SC-TM-65-135, September 1965.

"The amount of improvement which can be obtained from error reduction programs in industry is a function of two factors -- modifying people through motivational programs and modifying the work situation. Most of the emphasis in industry has been placed on modifying people. But the extent of improvement that can be obtained through motivational programs in limited and often transitory. Considerably greater and permanent improvement can be obtained through redesign of the work situation.

Industry's emphasis on modifying people stems from a misunderstanding of the nature of human error; namely, the belief that human error is exclusively the result of a poorly motivated program.

628 Rosenblatt, F. PERCEPTRON SIMULATION EXPERIMENTS. Proc IRE, 48, 301-309, 1960.

An experimental simulation program, which has been in progress at the Cornell Aeronautical Laboratory since 1957, is described. This program uses the IBM 704 computer to simulate perceptual learning, recognition, and spontaneous classification of visual stimuli in the perceptron, a theoretical brain model which has been described elsewhere. The paper includes a brief review of the organization of simple perceptrons, and theoretically predicted performances curves are compared with those obtained from the simulation programs, in several types of experiments, designed to study "forced" and "spontaneous" learning of pattern discriminations.

629 Rowan, T.C. SIMULATION IN AIR FORCE SYSTEM TRAINING. Report of System Simulation Symposium, D.G. Malcolm, (Ed.) Waverly Press, Baltimore, 1957. American Institute of Industrial Engineers, 83-87, 1958.

A description of the large-scale field training program which evolved from the laboratory experiments which RAND Corporation developed by simulation, in RAND's System Research Laboratory.

630 Rowe, A. APPLICATION OF COMPUTER SIMULATION OF PRODUCTION SYSTEM DESIGN. System Development Corporation, Santa Monica, California, SP-85, no date.

631 Rowe, Alan J. COMPUTER SIMULATION APPLIED TO JOB SHOP SCHEDULING. In: Report of System Simulation Symposium, American Institute of Industrial Engineers, 59-64, 1958.

Computer simulation seems to provide an effective means of simulating the shop conditions and problems and offers many advantages over testing in the real world of the machine shop itself.

632 Rowe, Alan J. A RESEARCH APPROACH IN MANAGEMENT CONTROL. Journal of Industrial Engineers, 11(3), 251-258, May-June 1960.

The investigation of system optimization and management controls is discussed. Specific aspects are (1) formalization of objectives, (2) measurement of system performance, (3) the use of decision rules in a computer simulation of management controls, and (4) programming of a general management control model.

633 Royden, Halsey C., Patrick Suppes, and Karol Walsh. A MODEL FOR THE EXPERIMENTAL MEASUREMENT OF THE UTILITY OF GAMBLING. Behavioral Science, 4(1), 11-18, 1959.

More than money may be involved in the gambler's expected gain. Gambling itself may have a "utility" for him. This paper presents a theory of gambling decisions which takes into account both utilities.

634 Ryan, T. Antoinette. USING SIMULATED SITUATION PROBLEM SOLVING TASKS TO INCREASE ABILITY TO APPLY PRINCIPLES IN REALISTIC SETTINGS. Paper read at A.E.R.A. convention, Chicago, February 1965.

The purpose of the study was to compare specific learning outcomes of Ss who acquire information for immediate use in problem solving tasks with learning outcomes of Ss who acquire information end-of-course examinations. A theoretical rationale is presented. Results indicate that Ss who have a choice of method for acquiring information combined with practice in simulated problem solving requiring immediate use of acquired information do the best while students with no choice and no practice with simulated problem solving tasks do the poorest on a test of ability to use principles in realistic situations. Concludes that should give practice in problem solving under realistic conditions and create situations in which students can apply knowledge they have acquired.

635 Sackman, H. et al. EXPLORATORY EXPERIMENTAL STUDIES COMPARING ONLINE AND OFFLINE PROGRAMING PERFORMANCE. System Development Corporation, Santa Monica, California, December 1966.

> Studies measuring the performance of programers under controlled conditions for standard tasks. Describes and notes methodological problems encountered in designing and conducting the experiments, limitations of the findings, and hypotheses to account for results.

636 Sage, A.P. and J.L. Melsa. ELECTRONIC SIMULATION OF THE BIOLOGICAL CLOCK. In: Biological prototypes and synthetic systems, 1, Eugene E. Bernard and Morley R. Kare, (Eds.) Plenum Press, 170-182, 1962.

> A model is described which represents a rather complex hybrid adaptive control system, a type of system which hopefully may lead to improvements in the performance of many existing control and communications systems. Current investigations of the biological clock at the University of Arizona are attempting to explain the action of the clock on a cellular level and to include the learning process in the electronic model.

637 Sakaguchi, M. REPORTS ON EXPERIMENTAL GAMES. Statistical Applied Research, JUSE, 7, 156-165, 1960.

638 Samuel, A.L. ARTIFICIAL INTELLIGENCE: PROGRESS AND PROBLEMS. Computers and Automation, 12(3), 28-35.

> Some of the paradoxes and problems confronting those working with intelligent machines are considered.

639 Samuel, Arthur L. SOME STUDIES IN MACHINE LEARNING USING THE GAME OF CHECKERS. IBM Journal of Research and Development, 3(3), 210-229, 1959.

> The principles of machine learning verified by the experiments outlined in this article are applicable to many other situations.

640 Sawyer, Jack and Duncan MacRae, Jr. GAME THEORY AND CUMULATIVE VOTING IN ILLINOIS: 1902-1954. American Political Science Review, 56(4), 936-946, 1962.

This paper specifies a simple game theory model, and tries it out in a large number of actual cases; described is voting behavior as it was modeled, the game theory model employed, an empirical test of the model, and the implications of the results.

641 Sayre, Kenneth M. and Frederick J. Crosson, (Eds.) THE MODELING OF MIND: COMPUTERS AND INTELLIGENCE. University of Notre Dame Press, 1963.

Description of the computer-oriented technology of the simulation of mental behavior; appraisals of present achievements and future possibilities in efforts to learn about the human mind by constructing models which simulate its behavior. Modeling, simulation and replication, p. 3-24.

642 Schaeffer, K.H., *et al*. THE KNOWLEDGEABLE ANALYST: AN APPROACH TO STRUCTURING MAN-MACHINE SYSTEMS. Stanford Research Institute, Menlo Park, California, Project No. IMU-3546 (Air Force Technical Report AFOSR 4490), Contract No. AF 49 (638)-1020, February 1963.

"In an attempt to evolve a general method for system analysis, this paper presents the matrix--network approach for the analysis of complex man-machine systems. This approach consists of seven steps which show how a system can be structured and how mathematical models of systems aspects can be incorporated into the overall analysis. However, some of these steps involve, besides formal rules, the judgement of knowledgeable analysts. To delve deeper into this judgement function, various logical, methodological, and psychological aspects concerning this function are discussed by different authors. On the basis of these discussions the principal author develops requirements which must be met by successful approaches to the structuring of complex systems."

643 Schalock, Henry D., James H. Beaird and Helen Simmons. MOTION PICTURES AS TEST STIMULI: AN APPLICATION OF NEW MEDIA TO THE PREDICTION OF COMPLEX BEHAVIOR. Final Report Title VII, Project No. 971, Teaching Research Division, Monmouth, Oregon, December 1964.

The purpose of the study was to test the theoretical position that the more closely test stimuli represent the stimuli present in life situations, the more likely responses to the test stimuli will predict behavior occurring in life situations. Four tests, ranging from a paper and pencil test to a simulation test using free responses and motion picture stimuli, were used as predictors. The criterion measure was the behavior of subjects in actual classroom situations. Analysis of the data supported the basic hypothesis.

644 Schelling, Thomas C. EXPERIMENTAL GAMES AND BARGAINING THEORY. In: The international system, theoretical essays. Klaus Knorr and Sidney Verba, (Eds.) Princeton University Press, 47-68, 1961.

Games may be used, this paper suggests, for purposes of research, the participants being scholars and policy analysts; or, games may be organized as training devices, to give students vicarious experience in the complexities of international politics. Three main elements regarding the use of games are described: (1) the game itself, (2) what is observed (outcome of game, behavior of players, particular situations that develop in the course of play) and (3) the question or hypotheses that guide the inquiry, toward which the manipulation of the game and the observation of game phenomena are oriented.

645 Schelling, Thomas C. THE STRATEGY OF CONFLICT. Journal of Conflict Resolution, 2, 203-264, 1958.

This paper attempts to enlarge the scope of game theory, taking the zero-sum game to be a limiting case rather than a point of departure.

646 Scherer, B.F. EFFECTIVENESS OF THREE METHODS OF INSTRUCTION IN A DRIVER IMPROVEMENT SCHOOL PROGRAM. Paper presented at Research Section and Council, National Convention of American Association for Health, Physical Education, and Recreation, Minneapolis, Minnesota, May 1963.

647 Schild, E.O. LEARNING IN SIMULATED ENVIRONMENTS. Proceedings of the Rider College School of Education Conference: New Approaches to Social Studies. Rider College, Trenton, New Jersey, 1966.

648 Schild, E.O. THE SHAPING OF STRATEGIES. American Behavioral Scientist 10(2), 1-4, Part II, 1966.

Simulation games present contingencies which reinforce effective strategies. The learning of such strategies is demonstrated and viewed as basic to the use of games in education and research.

649 Schultz, Duane P. GROUP BEHAVIOR IN A SIMULATED-ESCAPE SITUATION. Journal of Psychology, 61(1), 69-72, 1965.

A study was performed which involved a partial-replication and extension of the well-known Mintz study on nonadaptive group behavior in a simulated-panic situation. Ss were placed in the Mintz-type situation from which they were to escape under two incentive conditions: (1) monetary regard for escape and fine for failure to escape, as in the Mintz study; and (2) a more severe threat of electric shock for failure to escape. As compared with Ss in a control condition only Ss in the reward-and-fine groups demonstrated a significant decrement in escape behavior. The data suggest that the behavior of the Ss in the schock group was more efficient and adaptive than that of Ss of the reward-and-fine groups. A possible explanation for this finding is presented, along with the suggestion that the Mintz technique does not provide a meaningful simulation of a naturalistic-panic situation.

650 Scott, E. SIMULATION OF SOCIAL PROCESSES. A preliminary report of a survey of current research in the behavioral sciences. System Development Corporation, Santa Monica, California, TM-435, 1959. 15pp.

651 Sears, R.E. and S.M. Khanna. SIMULATION OF AN ASSEMBLY OF SIMPLIFIED NERVE CELLS ON A DIGITAL COMPUTER. Fall Joint Computer Conference, AFIPS Conference Proceedings, 24, 15-25, 1963.

A digital computer program simulating an assembly of simplified nerve cell models has been developed for an IBM 709 Data Processing System.

652 Seidel, R.J. PROGRAMED LEARNING: PROLOGUE TO INSTRUCTION. Professional Paper 17-67. The George Washington University, Human Resources Research Office, Alexandria, Virginia, April 1967. (AD 651052).

The paper indicates some pertinent issues in the field of programmed instruction (PI) and suggests promising directions for future growth of PI, both as a medium for the application of principles of learning and as a means of furthering our understanding of the learning processes. Practical and theoretical implications are touched upon and combined to give a position statement on PI as a pedagogical and psychological research tool. In this vein the utility and inevitability of computer-aided instruction are discussed.

653 Selfridge, Oliver G. PANDEMONIUM: A PARADIGM FOR LEARNING In: Mechanization of thought processes, Proceedings of a Symposium held at the National Physical Laboratory on 24th, Laboratory, Symposium No. 10. Her Majesty's Stationery Office, London, England, 511-526, 1, 1959. (This paper was reissued at MIT Press, Lexington, Massachusetts, September 8, 1958 and March 4, 1959).

In this paper a model is proposed for a process which, it is claimed, can adaptively improve itself to handle certain pattern recognition problems which cannot be adequately specified in advance.

654 Sermat, Vello and Robert P. Gregovich. THE EFFECT OF EXPERIMENTAL MANIPULATION ON COOPERATIVE BEHAVIOR IN A CHICKEN GAME. Psychonomic Science, 4(12), 435-436, 1966.

Forty male and forty female undergraduates participated in a mixed-motive game. For the first 50 trials, a simulated "other player" used a tit-for-tat strategy which reciprocated Ss choices with a one-trial lag. Ss who received the same choice from the "other" on the first trial became significantly more cooperative in the next 50 trials than Ss who received a different choice. A second phase explored some experimental treatments which were designed to change the degree of cooperation or competition shown by Ss, and demonstrated significant effects in the predicted direction.

655 Shapley, L.S. SIMPLE GAMES: AN OUTLINE OF THE DESCRIPTIVE THEORY. Behavioral Science, 7(1), 59-66, January 1962.

Simple games refer to multiperson games in which each coalition that might form is either all-powerful or completely ineffectual. The mathematical techniques and theoretical structure involved in these simple games are discussed. Comments are made regarding the application of this model to the United States Congress, the United Nations Security Council, or "any 'political' structure in which power and authority, rather than a monetary type of payoff, is the fundamental driving force." Implications for organizations, committees, and "neural nets" are noted.

656 Shears, Loyda M. PATTERNS OF COALITION FORMATION IN TWO GAMES PLAYED BY MALE TETRADS. Behavioral Science, 12(2), 130-137, 1967.

A study of behavior in two-person games; it is proposed that differential pressures are brought to bear on the different power positions in different game-situations; however, further study of the bargaining process would be needed to establish the worth of such an hypothesis.

657 Shoulders, K.R. SIMULATION OF NEURAL NETWORKS BY OPTICAL-PHOTOGRAPHIC METHODS. Stanford Research Institute, Menlo Park, California, December 1959.

658 Shriver, June D. GENERALIZABILITY OF GAME PLAYING SKILL. Technical Report No. 3, The University of Akron, Akron, Ohio. 113 pp. (AD 646 377).

This study attempted to discover whether (1) skill in one strategic game generalizes to another strategic game, (2) strategic skill is different from puzzle solving skill, and whether (3) preference for and experience in strategic games or (4) personality factors as measured by the Guilford-Zimmerman Temperament Survey are related to skill in games of strategy. (1), (3), and (4) were not supported by the results while (2) was. Author states study "resulted in a restructuring of the concept of the nature of games as models of serious decision-making situations.

659 Shubik, Martin. BIBLIOGRAPHY ON SIMULATION, GAMING, ARTIFICIAL INTELLIGENCE, AND ALLIED TOPICS. Journal of American Statistical Association, 55(292), 736-751, December 1960.

A total of 344 references to books, bibliographies, papers, and articles are presented under the headings: (1) Simulation, (2) Gaming and allied topics, (3) Monte Carlo, (4) Systems, and (5) Artificial intelligence and other allied topics.
The type of reference varies from exceedingly simple expository pieces to complex technical papers.

660 Shubik, M. (Ed.) GAME THEORY AND RELATED APPROACHES TO SOCIAL BEHAVIOR. Wiley, New York, 1964.

A book of selections designed to sketch in a nontechnical manner a part of the new developments in game theory and allied topics. Describes the types of problems to which the new methods apply. The selections are geared to the concept of game theory as a method for the study of decision making in situations of conflict.

661 Shubik, Martin. GAME THEORY AS AN APPROACH TO THE FIRM. American Economic Review, 50(2), 556-559, 1960.

Games of economic survival -- closely related to the gambler's ruin problem studied in probability theory -- provide a formalization for a dynamic model of the firm.

662 Shubik, M. SIMULATION, ITS USES AND POTENTIAL, PART I. Processed. General Electric Company, New York, Expository and Development Paper No. 2, June 25, 1958.

663 Shubik, M. SIMULATION, ITS USES AND POTENTIAL, PART II. Processed. General Electric Company, New York, Expository and Development Paper No. 3, May 4, 1959.

664 Shubik, Martin. SIMULATION OF THE FIRM. The Journal of Industrial Engineering, 9(5), 390-392, 1958.

What is meant by simulation of the firm? The construction and operation of models of its processes such as: production, inventory scheduling and forecasting and, eventually, the construction of models for pricing, advertising and other major decision areas. This article discusses the development of goals or intentions involved in undertaking simulation work with regard to distribution systems.

665 Shubik, Martin. SIMULATION OF THE INDUSTRY AND THE FIRM. American Economic Review, 50(5), 908-919.

A description of the difference between simulation and allied techniques; man-machine simulations, tactical simulation, exploratory or strategic simulation -- all are considered. Part II of this paper describes simulation of an industry or firm as a technique for the study of a new scientific institutional economics.

666 Shubik, M. SOME EXPERIMENTAL NON-ZERO-SUM GAMES WITH LACK OF INFORMATION ABOUT THE RULES. Management Science, 8(2), 215-234, 1962. (Cowles Foundation Discussion Paper No. 105, January 1961).

A discussion of the relationship between the theory of games and experimental gaming is presented. This includes comments on games of indefinite length and lack of knowledge concerning the rules. Six simple games are constructed and examined in the light of four different solution concepts. These games were used in an experiment with a class of Yale seniors as the subjects. The results of these experiments are discussed. They appear to lend weight to the noncooperative equilibrium concept of solution.

667 Shultz, G.L. THE USE OF THE IBM 704 IN THE SIMULATION OF SPEECH RECOGNITION SYSTEMS. International Business Machines Corporation, Yorktown Heights, New York, 1958.

The first step in mechanical speech recognition involves the analysis of a large number of speech sounds to determine the characteristics by which these may best be discriminated. To accomplish this analysis special advantage is taken of techniques made possible by the advent of a large scale digital computer. This paper describes the equipment required to both facilitate editing samples of sounds for analysis and convert these sounds to digital form suitable as computer inputs. A system of programs is presented and the feasibility of the computer as a research tool is illustrated.

668 Shure, Gerald H. and Robert J. Meeker. BARGAINING AND NEGOTIATION BEHAVIOR. Technical memorandum. Technical Memorandum No. TM-2304/100/00, System Development Corporation, Santa Monica, February 1967.

Research employing on-line computer experiments in bargaining and negotiation processes was conducted to evaluate the effects of: (a) cooperative bargaining strategies, (b) variations in threat availability and use, and (c) variation in bargainer's personality characteristics and attitudes. This report reviews the progress of research activities conducted with six experimental games, of associated programming developments, and of plans to extend the computer-based laboratory approach to more complex gaming. (author).

669 Shure, Gerald H. and Robert J. Meeker. REAL-TIME COMPUTER STUDIES OF BARGAINING BEHAVIOR: THE EFFECTS OF THREAT UPON BARGAINING. System Development Corporation, Santa Monica, California, SP-1143-000-01, September 16, 1963.

Reports on a communication game, in which the computer is used as an experimental tool for on-line analysis, umpiring, control and recording of subject behavior, also reports that the computer is programmed to aid in probe subjects' as to their intentions and perceptions at critical points in the development of the bargaining process. States that these data should supplant a great deal of the need to speculate about the patterns of intention and perceptions which produce the overt results obtained. (Author).

670 Siegel, Arthur I. COMPUTER SIMULATION OF MAN'S PERFORMANCE IN MAN-MACHINE SYSTEMS. *Naval Research Reviews*, 10-13, June 1961.

A description of how simulation technique works in the impersonation or simulation of a human machine operator at work under various conditions. It has been found possible to simulate in the computer such human factors as stress and urgency conditions and even the point beyond which the human operator would be expected to break down.

671 Siegel, Arthur I. and J.J. Wolf. *DIGITAL SIMULATION OF SUBMARINE CREW PERFORMANCE, II COMPUTER IMPLEMENTATION AND INITIAL RESULTS OF THE APPLICATION OF A PSYCHOSOCIAL "MODEL" FOR DIGITALLY SIMULATING CREW PERFORMANCE*. Applied Psychological Services, Wayne, Pennsylvania, Contract Nonr-4021(00) (FBM), August 1965.

"The stochastic, digital simulation model for simulating confined crews, which was previously derived and presented. . . was modified and (the) revised logic was discussed. . . . the sensitivity of this psychosocially-oriented model was tested using a hypothetical 10 day mission for crews ranging from 33 to 44 men. The parameters and constants were selected so as to investigate the granularity (precision) and polarity (direction) of results generated by the model. The overall results, for the hypothetical mission, ... appear reasonable and in the anticipated direction. ... The simulated 12 hour work day was indicated to yield about the same efficiency as the 8 hour work day ... the morale levels for both work day lengths appeared to be about at the same level."

672 Siegel, Arthur I. and J. Jay Wolf. DIGITAL SIMULATION OF SUBMARINE CREW PERFORMANCE: II. COMPUTER IMPLEMENTATION AND INITIAL RESULTS OF THE APPLICATION OF A PSYCHOSOCIAL "MODEL" FOR DIGITALLY SIMULATING CREW PERFORMANCE. Applied Psychological Services, Wayne, Pennsylvania, 1965.

The model described in the first of a series of reports is a technique for simulating the performance of submarine crews operating in confined quarters for extended time intervals. Some general aspects of simulation, as they apply to the model, are described. Computer and computer programing aspects of the model are presented. A hypothetical ten day mission, generated to approximate a potentially realistic situation, is presented and employed as a demonstration of the sensitivity of some of the model's critical parameters.

673 Siegel, A.I. and J.J. Wolf. A MODEL FOR DIGITAL SIMULATION OF TWO-OPERATOR MAN-MACHINE SYSTEMS. Ergonomics, 5(4), 557-572, 1962.

The model used requires twelve items of input data for each subtask and each operator, the initial conditions and the parameters. These are described. The model was used to simulate in-flight refueling and an air intercept ". . . it appears that for predicting operator effectiveness on tasks similar to those simulated, the model may be used with some degree of confidence."

674 Siegel, A.I. and J.J. Wolf. MODIFICATION AND FURTHER EVALUATION OF A DIGITAL MAN-MACHINE SIMULATION MODEL. applied Psychological Services, Wayne, Pennsylvania, 1963.

> The applicability of a previously derived digital computer simulation model to uni-operator situations and the effects of certain modifications on the agreement of the results from application of the model with criterion data were investigated. The results suggest that the model is usable for uni-operator and two-operator simulations. The modified model also achieved an agreement level with outside criterion data that had not been previously accomplished.

675 Siegel, Arthur I. and J.J. Wolf. TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN MACHINE SYSTEMS: A DESCRIPTION OF A MODEL FOR THE RESULTS OF ITS FIRST APPLICATION. Applied Psychological Services, 1959. (AD 216 538).

> A psychological mathematical model was synthesized which the authors thought would permit an improved analysis and prediction of the effectiveness of man-machine systems. The model was applied to the pilots' task in landing an F4D aircraft on an aircraft carrier. The predictions from the model indicate that many conditions necessary to the eventual fruition of a final model have been met.

676 Siegel, A.I. and J.J. Wolf. TECHNIQUE FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS, MODIFICATION AND FURTHER EVALUATION OF A DIGITAL MAN-MACHINE SIMULATION MODEL. Applied Psychological Services, Wayne, Pennsyvania, Contract No. Nonr-2492 (00), July 1963.

> "A digital computer simulation model was previously derived and employed for simulating the performance of the operator(s) in a man-machine system. The technique is based on an analysis of the performance of each operator, arranged into ordered, discrete actions called 'subtasks', and the compilation of each of certain source data.
> Since the development of the original model, a number of possible modifications have become apparent. Moreover, although logical expectancy indicated the model to be usable for either one or two operator systems, the model had never been exercised on a uni-operator system. Accordingly, the present study focused on

investigating: (1) the applicability of the model to uni-operator situations, and (2) the effects of the modifications on the agreement of the results from application of the model with criterion data. The results suggested that the model is usable for uni-operator and for two-operator simulations. The modified model, which demonstrated general reasonableness and rationality, also achieved an agreement level with outside criteria on data that had not been previously accomplished."

677 Siegel, A.I., R.S. Lanterman and J.J. Wolf. TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS: FURTHER TEST AND EVALUATION OF A MAN-MACHINE SIMULATION MODEL. Applied Psychological Services, Wayne, Pennsylvania, 1963.

The predictions by a digital simulation model of the ability of two selected teams, a "fast" team and a "slow" team, to perform a simulated man-machine task were compared with the actual performance of the teams on the task. Reasonable agreement was found between the model's predictions and the actual criterion data in four areas: success proportion, total time used, time used to intermediate subtasks, and effects of simulated-machine failure on performance. It was contended that the model may be employed for simulating teams for whom appropriate input data are available or can be acquired.

678 Siegel, A.I., et al. DIGITAL SIMULATION OF SUBMARINE CREW PERFORMANCE: I. LOGIC OF A PSYCHOLOGICAL "MODEL" FOR DIGITALLY SIMULATING CREW PERFORMANCE. Applied Psychological Services, Wayne, Pennsylvania, 1964.

A logic and subsequent model were developed and are presented for digitally simulating crew performance in a closed man-machine system. The model has as its primary aim the prediction of system effectiveness using psychological variables. The computational techniques are formulated for a digital computer in accordance with psychological consideration and are based on expected military, social, and environmental conditions. Results expected to be available from the model, including measures of system effectiveness, personnel loading, and personnel data, are described.

679 Siegel, A.I. and J.J. Wolf. A TECHNIQUE FOR EVALUATING MAN-MACHINE SYSTEM DESIGNS. Human Factors, 3, 18-28, March 1961.

> "A computer based method for digitally simulating the performance, in one-operator systems, of operators who possess various characteristics is described. The method is believed applicable for evaluating various system designs while the system is in the early design stage. Two operational tasks, landing an F4D aircraft on a carrier and firing an air-to-air missile, were simulated using the method. The predictions from the model were compared with outside criterion data for the same tasks. The predictions are held to conform generally with reality and to be reasonable. The results of the two applications of the model were in general agreement. It is held that the model may be considered sound and may now be tentatively employed for comparative evaluation of alternative system designs or for predicting system performance."

680 Siegel, A.I., J.J. Wolf and R.T. Sorenson. TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS (EVALUATION OF ONE OR A TWO OPERATOR SYSTEM EVALUATIVE MODEL THROUGH A CONTROLLED LABORATORY TEST). Applied Psychological Services, Wayne, Pennsylvania, July 1962.

> "A stochastic, digital computer situation model was previously derived for and applied to the problem of simulating one or two operator man-machine systems. Further test of the validity of the model through comparisons of the model's predictions of team performance with the actual performance of trained teams on a man-machine task is described. A complex two operator man-machine equipment test involving team and individual branching, operator stress build-up, looping, cooperative work, communication, waiting, etc., was developed. ... it was concluded that support is gained for a contention favoring the validity of the model."

681 Silk, L.J. THE GENTLE ART OF SIMULATION. Business Week, 73-82, November 29, 1958.

> A "popular" report on the uses of simulation in the Air Force, large firms, RAND, and others; an account of how simulation techniques were first used.

682 Silvern, Leonard C. PROGRAMMED INSTRUCTION AND COMPUTER-ASSISTED INSTRUCTION - HOW THEY CAN BE USED EFFECTIVELY IN OUR TRAINING PROGRAMS. Education and Training Consultants Company, Los Angeles, California, 1967.

Programmed Instruction, a method of teaching subject-matter without the intervention of a human instructor, is being used profitably in civilian and military aerospace applications. A more sophisticated technique which utilizes time-sharing computer systems. Computer Assisted Instruction (CAI), provides a learner-machine relationship not previously attainable.
The evolving roles of the participants are discussed: learner, instructor, instructional programmer, computer programmer, computer operator, and training director. Reference is made to CAI software systems and languages, and the development of "Elements of EYBOL", a missle orientation training program is described in detail.

683 Silvern, L.C. A GENERAL SYSTEM MODEL OF PUBLIC EDUCATION. K-12. Educational New Service, Saddlebrook, New Jersey, 1964.

A discussion of the "systems approach" to training. Then terms defined and the systems concept with flow chart conceptualizations of other writers in the fields of industry and education were illustrated. Then a comparison was made between mathematical and flow chart systems models. In conclusion, examples of general systems models applied to higher education, business and industrial training, and public education, K-12 were presented.

684 Silvern, L.C. FUNDAMENTALS OF TEACHING MACHINE AND PROGRAMED LEARNING SYSTEMS, ADMINISTRATIVE FACTORS GUIDE. Education and Training Consultants Company, Los Angeles, 1964.

Contains 4 chapters dealing with the origin, history and philosophy of his Fundamentals Course, course development and validation, analysis of the target data, and factors which contribute to course success. Teaching points of the course are grouped into the following units: (1) Introduction to the course, (2) Concepts of human performance, (3) Basic analysis, (4) Job analysis, (5) Performance standards,

(6) Course outlining, (7) Lesson planning, (8) Learning psychology, (9) Producing the lesson, (10) Evaluating transfer to real-life situations, and (11) Evaluating yourself in this course.

685 Silberman, Harry F. USING COMPUTERS IN EDUCATION: SOME PROBLEMS AND SOLUTIONS. Professional paper SP-2545/002/00, System Development Corporation, Santa Monica, California, November 1966.

An instructional management system is described as an interimstep to computer assisted instruction. The rationale for the instructional management system stems from the consideration of several problems in using computers in education; problems of system development, cost, communication, system integration, and user acceptance are considered.

686 Simmons, P.L. and R.F. Simmons. THE SIMULATION OF COGNITIVE PROCESSES, II: AN ANNOTATED BIBLIOGRAPHY. IRE Transactions on Electronic Computers, EC-11, 535-552, August 1962. (A supplement to the annotated bibliography in Vo. EC-10).

687 Simmons, P.L. and R.F. Simmons. THE SIMULATION OF COGNITIVE PROCESSES: AN ANNOTATED BIBLIOGRAPHY. IRE Transactions on Electronic Computers, EC-10, 462-483, September 1961.

Subjects include: (1) Theoretical formulations and discussions, (2) Mathematical models, automata, and probabilistics, (3) Formal nerve nets, (4) Neurophysiology, (5) Simulated neurons and organism, (6) Pattern recognition, (7) Games, problem-solving, heuristics, (8) Learning systems, and (9) Miscellaneous cybernetics (untranslated and secondary sources).

688 Simon, Herbert A. A BEHAVIORAL MODEL OF RATIONAL CHOICE. Quarterly Journal of Economics, 69(1), 99-118, 1955.

The aim of the paper is to construct definitions of "rational choice" that are modeled more closely upon the actual decision processes in the behavior of organisms than definitions heretofore proposed. The proposal is to provide some materials for the construction of a theory of the behavior of a human individual or of groups of individuals who are making decisions in an organizational context.

689 Simon, Herbert A. MODELING HUMAN MENTAL PROCESSES. In: *Proceedings of the Western Joint Computer Conference. 1961*. Western Joint Computer Conference, Los Angeles, California, 1961.

There now exists at least a half dozen computer programs that simulate some of the information processes that humans use to perform problem solving, learning, perceiving, and thinking tasks. These programs constitute theoretical explanations of the corresponding human behavior, and can be tested by comparing the computer traces they produce with the verbal behavior of subjects in the psychological laboratory. This paper surveys this new kind of theory building and theory testing in psychological laboratory. This paper surveys this new kind of theory building and theory testing in psychology, and relates it to other uses of simulation as a tool of psychological research.

690 Simon, Herbert A. and Edward A. Feigenbaum. AN INFORMATION-PROCESSING THEORY OF SOME EFFECTS OF SIMILARITY, FAMILIARIZATION, AND MEANINGFULNESS IN VERBAL LEARNING. *Journal of Verbal Learning and Verbal Behavior*, 3(5), 385-396, 1964.

Results obtained by simulating various verbal learning experiments with the Elementary Perceiving and Memorizing Program (EPAM) are presented and discussed. Predictions were generated for experiments that manipulated intralist similarity;...interlist similarity;... and familiarity and meaningfulness. The stimulus materials were nonsense syllables learned as paired-associates. The predictions made by the model are generally in good agreement with the experimental data.

691 Simon, Herbert A. and P.A. Simon. TRIAL AND ERROR SEARCH IN SOLVING DIFFICULT PROBLEMS: EVIDENCE FROM THE GAME OF CHESS. *Behavioral Science*, 7(4), 425-429, 1962.

The conclusion is reached that the discovery of "mating combinations by expert chess players requires neither prodigious memory, ultra-rapid processing capacities, nor flashes of insight. Combinations as difficult as any that have been recorded in chess history will be discovered by the selective heuristics we have outlined, with amounts of search and with processing speeds that do not appear extravagent in relation to the measures we have of simpler kinds of human information-processing performance. The evidence suggests strongly that expert chess players discover combinations because their programs incorporate powerful selective heuristics and not because they think faster or memorize better than other people."

692 Singleton, J.W. and H. Tomach. SIMULATION OF LARGE SCALE MAN-MACHINE SYSTEMS. Sp-83, System Development Corporation, Santa Monica, California, September 1958.

693 Slattery, Howard F., et al. A SIMULATION STUDY OF AIRCRAFT PROFILE CONCEPTS IN DPC. National Aviation Facilities Experimental Center, Atlantic City, New Jersey, Interim Rept. Task No. 105-6-5T, 1961.

The objectives of this task were to test, by simulation, the validity of aircraft performance profile concepts, as proposed for the DPC program, and their effect on the available airspace. Five simulation phases were planned in order to cover the broad scope of this task. In Phase IA, the emphasis was on the metering of arriving aircraft through the transition area. In order to study this area, a transition radar console, a sequence console, and computer-generated tracking gates were simulated.

694 Smith, N.M., Jr. A RATIONALE FOR OPERATIONAL GAMING. Paper presented to 8th national meeting of the Operations Research Society, Ottowa, Canada, January 10, 1956.

695 Smith, R.G., Jr. BEYOND PROGRAMED INSTRUCTION. Presidential address delivered at the annual convention, National Society for Programed Instruction, April 1964.

Discusses the ongoing merger of the system idea with the technology of training and the techniques of programing which forms the basis for the beginnings of the development of instructional systems. He predicts that the merger will provide a new stimulus for a more realistic and practical approach to the design and development of teaching situations, and will bring the role of the teacher into sharper focus.

696 Smith, R.G., Jr. THE DESIGN OF INSTRUCTIONAL SYSTEMS. The George Washington University, Human Resources Research Office, Alexandria, Virginia, Technical report, 66-18, November 1966.

> This report, based on an extensive survey of current literature, describes and discusses a system approach to designing training and considers factors bearing on training effectiveness. An efficient instructional system is conceived as one in which the components form an integrated whole, achieving maximum effectiveness at the least possible cost. Components considered in this report include presentation media, student management, techniques for practicing knowledge and performance, knowledge of results, directing student activities toward the goals of the training program, and testing and evaluating the system in terms of efficiency and cost.

697 Smith, R.G., Jr. CONTROLLING THE QUALITY OF TRAINING. The George Washington University, Human Resources Research Office, Alexandria, Virginia, Technical report 65-6, June 1965.

> The need for a quality control system in a military training program and methods of establishing such a unit are described and evaluated in this report, which is part of a research project in the technology for developing training. It is stated that the purpose of quality control is to ensure a satisfactory standard of competence among the students who graduate, to maintain this quality by a continuous monitoring process, and to improve training where it is found to be deficient. In order to function successfully, a quality control system should constitute a separate unit, independent of but cooperating with the instructional departments. Attention is given to proficiency testing as the chief means of measuring the success of the training program, with emphasis upon the importance of a uniform standard and consistent method in the preparation, administration, and scoring of tests.

698 Smith, R.G., Jr. AN ANNOTATED BIBLIOGRAPHY ON THE DETERMINATION OF TRAINING OBJECTIVES. The George Washington University, Alexandria, Virginia, June 1964. (AD. 448 363).

Prepared to provide a basis for a practical manual on the determination of training objectives. References are listed alphabetically by author within 7 categories: (1) General rationales, (2) System analysis, (3) Job analysis, (4) Allocation of training, (5) Task description, (6) Determination of knowledges and skills, and (7) Description of objectives.

699 Smith, R.G., Jr. AN ANNOTATED BIBLIOGRAPHY ON PROFICIENCY MEASUREMENT FOR TRAINING QUALITY CONTROL. The George Washington University, Human Resources Research Office, Alexandria, Virginia, June 1964.

The bibliography was prepared to provide a basis for a practical manual on quality control in training. References are listed in alphabetical order by author within five categories: (1) General, (2) Test manuals, (3) Test methods, (4) Quality control systems, and (5) Test development and description.

700 Smith, S.L. ADDING INTEREST VIA SHORTHAND GAMES. Journal of Business Education, 41, 279-280, April 1966.

701 Smode, A.F., Alin Gruber and J.H. Ely. HUMAN FACTORS TECHNOLOGY IN THE DESIGN OF SIMULATORS FOR OPERATOR TRAINING. Dunlap and Associates, Inc., Stanford, Connecticut, Technical Report No. NAVTRADEVCEN 1103-1, December 1963.

This report presents an organized body of information useful for dealing with those human factors problems frequently encountered in the development of the Weapons System Trainer. Emphasis is given throughout to the general problems involved in developing the complete training system rather than to the analysis of details specific to given training systems. It summarizes basic human factors information which influences the design and construction of training devices. Chapters are devoted to determining training needs, developing the environment for learning, understanding simulation requirements for training, developing a measurement capability, and discussing the human engineering problems in trainer design.

702 Smode, A.F., A. Gruber and J.H. Ely. THE MEASUREMENT OF ADVANCED FLIGHT VEHICLE CREW PROFICIENCY IN SYNTHETIC GROUND ENVIRONMENTS. USAF MRL, Technical Documentary Report 62-2, February 1962.

This report is devoted to the presentation and discussion of major considerations in the design of systems for measuring the proficiency of advanced flight vehicle crews in synthetic ground environments. Emphasis is given throughout to the logic of proficiency measurement and the general problems involved rather than to the analysis of specific details. Successive portions of the report deal with general measurement concepts, procedures and steps in designing measurement systems, an example application of the material presented, and the anticipated characteristics of advanced flight vehicle simulation equipment related to proficiency measurement. In addition, a historical overview of aircrew proficiency measurement emphasizing early work and a list of study references on rating methods are appended as it provides a considerable background of information of proficiency measurement, this report will be of interest to individuals directly concerned with simulator training programs, proficiency evaluation and standardization, training standards, and training equipment procurement for advanced flight systems.

703 Smode, Alfred F. and Donald E. Meyer. RESEARCH DATA AND INFORMATION RELEVANT TO PILOT TRAINING: I. GENERAL FEATURES OF AIR FORCE PILOT TRAINING AND SOME RESEARCH ISSUES. USAF AMRL, Technical Report No. 66-99-1, 1966.

Describes general features of Air Force pilot training from entry into the undergraduate pilot training program through the specialized schools conducted by the major using commands. As a result of on-site visits with authoritative training personnel, a number of researchable issues that hold promise for the improvement of selected aspects of pilot training are reported.

704 Snyder, R.C. SOME PERSPECTIVES ON THE USE OF EXPERIMENTAL TECHNIQUES IN THE STUDY OF INTERNATIONAL RELATIONS. In: Simulation in international relations: Developments for research and teaching. Prentice-Hall, 1-23, 1963.

This paper presents major trends in simulation, types of experimentation, heuristic uses of simulation, simulation for teaching and training, motivation in the simulation context, relation of teaching-oriented simulation to research. Materials useful in the college teaching of internation simulation are provided.

705 Soblin, D., et al. PHYSICAL SIMULATION. N-9244, System Development Corporation, 1959.

706 Solomon, H. and M. Denicoff. SIMULATIONS OF ALTERNATIVE ALLOWANCE LIST POLICIES. Processed. The George Washington University Logistics Research Project NR 047 001, ONR, Serial T-102/59, Alexandria, Virginia, May 1959.

707 Spesock, G.J. and R.S. Lincoln. HUMAN FACTORS ASPECTS OF DIGITAL COMPUTER PROGRAMMING FOR SIMULATOR CONTROL. Human Factors, 7(5), 473-482, 1965.

Because of the enormous present day effort devoted to the preparation of digital computer programs, special attention should be given to the human factors aspects of program development. Currently available program compilers represent a significant application of certain human factors principles, but are not generally applicable to problems of "real time" programing. Since the creation of appropriate compilers is important to simulation methodology, a "real time" compiler developed for display/control simulation on a small computer in a human factors laboratory is described in detail.

708 Sprague, H. and Associates. OCCASIONAL NEWSLETTER ABOUT USES OF SIMULATIONS AND GAMES FOR EDUCATION AND TRAINING. Project Simile, Western Behavioral Sciences Institute, LaJolla, California.

709 Sprowls, R. Clay and M. Asimow. A COMPUTER SIMULATED BUSINESS FIRM. In: Management control system, D.G. Malcolm, et al., (Eds.). Wiley, 321-332, 1960.

A description of the TASK Manufacturing Corporation, which is a small business firm, computer-simulated, which utilizes the 709 data-processing machine located in the Western Data Processing Center at UCLA. It is designed to explore research and educational possibilities of business operations.

710 Starbuck, W.H. and E. Kobrow. THE EFFECTS OF ADVISORS ON BUSINESS GAME TEAMS. American Behavioral Science, 10(2), 28-30, Part II, 1966.

The authors test the consequences of adding coaches to teams of graduate students playing a business management game.

711 Starnes, C.F. A DYNAMIC, STEREOSCOPIC DISPLAY OF PHASE-SPACE TRAJECTORIES BY PARALLAX SIMULATION. Unpublished Master's Thesis, Oregon State University, Corvallis, 1966.

The method of producing visual parallax developed in this thesis involves generating a diode equation approximation of the differential parallax equation from optical theory. Once the differential parallax is generated, it is used to modify a planar display so three dimensional vision is simulated with the aid of a stereoscopic viewer.

712 Steinemann, J. H. COMPARISON OF PERFORMANCE ON ANALYGOUS SIMULATED AND ACTUAL TROUBLESHOOTING TASKS. USN PRA Research Memorandum, No. SRM 67-1, 1966.

Compared the performance of a group of 14 Ss assessed on a simulated and an actual trouble-shooting task. Analysis of results revealed that the simulated performance measure did not provide a valid estimate of performance proficiency on the actual task. Obtained negative intertest correlations indicate that simulated test results would actually be misleading in terms of estimating actual performance scores. In addition to performance score discrepancies, there were observable differences in specific performance procedures and overall trouble-shooting strategy attributable to the differences in test mode. The evidence strongly suggests caution in assuming that a simulated performance measure, even with considerable face validity, will provide a valid estimate of actual performance on a common task.

713 Steiner, K. E. and Irene L. Cochran. THE SIMULATED CRITICAL INCIDENT TECHNIQUE AS AN EVALUATION AND TEACHING DEVICE. American Journal of Mental Deficiency, 70(6), 835-839, 1966.

Task-oriented evaluation, as a supplement to other efforts in inservice training, was facilitated by utilizing the simulated critical incident technique as an evaluation and teaching device. A group of 40 attendants from four classes were tested to determine their ability to perform seven different nursing procedures,and were rated on their performance both before and after the correct methods were taught and demonstrated in class. Following the posttesting, the individual attendant received immediate feedback on any errors made, and appropriate suggestions for correcting his future performance were given. Although the use of the simulated critical incident technique is still in an experimental or pilot stage, data collected to date tend to indicate the technique is a valuable tool in teaching and evaluating attendant performance.

714 Stewart, Edward C. SIMULATION EXERCISES IN AREA TRAINING. Conference Proceedings, report of the eleventh annual Army Human Factors Research and Development Conference, October 1965. Paper read at annual Army Human Factors Research and Development Conference, Fort Bragg, North Carolina, 1965.

Special techniques and content are being developed to supplement current area training programs. Simulation was chosen as the technique, and exercises were developed whose content emphasized the American culture and the foreign, host culture. These evolved as a confrontation between American cultural assumptions and values and a contrasting set, conceived for training and research purposes only, called contrast-American assumptions and values. When accompanied by appropriate introduction and critique, these exercises hold promise of achieving their training objectives.

715 Stewart, Edward C. THE SIMULATION OF CROSS-CULTURAL COMMUNICATION. Paper read at a symposium of the German Development Institute, Berlin, Germany, March 1966.

716 Stewart, Edward C. THE SIMULATION OF CULTURAL DIFFERENCES. Journal of Communication, 16(4), 291-304, 1966.

From the point of view of research, simulation of cultural differences provides the advantage of some control of variables in an area where experimentation is extremely difficult. The successful representation of significant cultural variables, makes it possible to explore cross-cultural phenomena, and to develop a body of knowledge in this area. This paper explores the possibility of simulation as a training technique which holds the promise of great effectiveness, since it provides active participation, or direct observations by students in a class.

717 Stewart, Edward C. SIMULATION TECHNIQUES FOR AREA TRAINING. The George Washington University, HumRRO, Alexandria.

This paper describes the technique of simulation as it is being used in training in military and other circles. Simulation is described here as a method of realistically showing the student how to learn about cultural differences in a live cross-cultural experience, and perhaps also to achieve a latent training effect, that is to say, to show training benefits of which the student himself is not aware.

718 Stitelman, L. A PUBLIC ADMINISTRATION DECISION MAKING SIMULATION. Mimeographed paper. Wayne State University, Detroit, May 1966.

An introduction to the simulation with specific directions and materials for the simulation.

719 Stolurow, L.M. A TAXONOMY OF LEARNING TASK CHARACTERISTICS. Technical Documentary Report No. AMRL-TDR-64-2, University of Illinois, Urbana, January, 1964. (AD 433 199).

This report is designed to assist a training specialist in the design and development of effective training programs in support of Air Force positions. It presents a system for classifying learning tasks and, research and analytical procedures are summarized along with findings produced by a tryout of the system with a group of training specialists.

720 Stolurow, L.M. TEACHING BY MACHINE. Cooperative Research Monograph No. 6, OE-34010, U.S. Government Printing Office, Washington, 1961.

The booklet presents an overview of teaching machines and programmed instruction.

721 Story, A.W. MAN-MACHINE SYSTEM PERFORMANCE CRITERIA. Electronic System Division, Air Force Systems Command, USAF, Bedford, Massachusetts, ESD-TR-61-2, May 1961. (AD 260528).

"Four categories of criteria are developed for the evaluation of man-machine system performance. The applicability of these criteria during system design, building, and testing is discussed. Some illustrative evaluations of man-machine systems are surveyed. Problems that accrue through the use of simulative features in the assessment of system performance are considered."

722 Suppes, Patrick, and R.C. Atkinson. MARKOV LEARNING MODELS FOR MULTI-PERSON INTERACTIONS. Stanford University Press, 1960.

The aim of this book is to apply a mathematical theory of behavior to small-group experiments that closely resemble game situations.

723 Sutton-Smith, Brian and John M. Roberts. STUDIES OF AN ELEMENTARY GAME OF STRATEGY. Genetic Psychology Monographs, 75(1), 3-42, 1967.

A series of studies with elementary school children, using a test of strategic competence based on the game of Tick-Tack-Toe, inquired into the relationships between competence at the game, and parallel cognitive, social, and physical processes. It was discovered that winning at this test by boys was related to a variety of other social and cognitive characteristics of an analogous nature. Results are interpreted in terms of a modeling and enculturative theory of games. (41 refs.)

724 Swain, A.D. SOME PROBLEMS IN THE MEASUREMENT OF HUMAN PERFORMANCE IN MAN-MACHINE SYSTEMS. Human Factors, 6(6), 687-700, December 1964.

"Quantification of human performance in man-machine systems is receiving more and more attention in human factors work. Obstacles to such quantification include: (1) complexity and subjectivity of available methods, (2) grossness of assumptions behind these methods, and (3) resistance of some psychologists.

Research is needed (1) to develop an improved human performance data bank, (2) to develop improved models and methods, and (3) to validate quantification data, models and methods."
There is a bibliography of forty-three references. This paper was also published as Sandia Corporation reprint SC-R-66-906.

725 Swain, A.D. THERP, Sandia Corporation, Albuquerque, New Mexico, SC-R-64-1388, October 1964.

"A point-estimate model for ascertaining the quantitative effects of human behavior upon man-machine system reliability is discussed. Some recent applications of the model and some of the research needs for improving this and other models to quantify human performance are described.
THERP (Technique for Human Error Rate Prediction) is a method for performing a human factors reliability analysis which has been used since 1961 by the Reliability Department at Sandia Corporation. ... models ... like THERP enable the user to make trade-offs between human reliability and equipment reliability in arriving at an acceptable level of man-machine system reliability which is commensurate with cost and time requirements."

726 Syn, W.M. and Robert N. Linebarger. A DIGITAL SIMULATION PROGRAM FOR CONTINUOUS SYSTEM MODELING. DSL/90. In: 1966 Spring Joint Computer Conference, AFIPS Conference Proceedings, 28, 165-187, Spartan Books, 1966.

Within IBM, DSL/90 has been used extensively in many different application areas including circuit design, mechanical dynamics, process analysis and control, servo design, aerospace flight simulation and biomedical modeling. Simplicity of the input language, clarity and completeness of both print and plot output, and the ease with which data is handled are some of the features which have made DSL/90 attractive to an increasing number of problem solvers from both camps -- analog and digital.

727 System Development Corporation. PACKAGED DISASTER. System Development Corporation Magazine, 9(6), 10-16, June 1966.

Description of a simulation which provides "responsible persons and agencies with concrete experience in emergency operations."

728 Tallmadge, G.K. and J.W. Shearer. STUDY OF TRAINING EQUIPMENT AND INDIVIDUAL DIFFERENCES. Technical Report: NAVTRADEVCEN 66-C-0043-1. American Institutes for Research in the Behavioral Sciences, Palo Alto, California, 1967. (AD 650 850).

Purpose of the project was to determine whether training effectiveness could be increased by employing training methods which differed as a function of trainee characteristics. The study involved two experimental groups and a control gorup and 16 measures of trainee aptitudes and interests. The experimental training methods were designed to reflect Gagne's (1965) chaining and principle learning theoretical constructs. Large achievement differences were noted with no interactions between training methods and learner characteristics either with single aptitude measures, combined measures, or by means of a covariance analysis. It was concluded that these negative findings resulted from the existence of interactions between suject matter content and training methods.

729 Taube, M. COMPUTERS AND COMMON SENSE: THE MYTH OF THINKING MACHINES. Columbia University Press, New York, 1961.

A critical and controversial assessment of man-machine relations; the author is against those who make promises that within ten years computers will discover important mathematical theorems. On the other hand, his view certainly does not indicate the present thinking of the mature members of the computing profession as reflected in their scientific journals. With respect to the simulation of the human brain, the author's thesis is that the "proper man-machine relation is one of complementation and augmentation, not simulation."

730 Teichroew, Daniel and John Francis Lubin. COMPUTER SIMULATION--DISCUSSION OF THE TECHNIQUE AND COMPARISON OF LANGUAGES. Communications of the ACM. 9(10), 723-741, 1966.

The purpose of this paper is to present a comparison of some computer simulation languages and of some of the packages by which each is implemented.

731 Teichroew, Daniel. A HISTORY OF DISTRIBUTION SAMPLING PRIOR TO THE ERA OF THE COMPUTER AND ITS RELEVANCE TO SIMULATION. Journal of American Stratistical Association, 60(1), 27-49, 1965.

> The history of distribution sampling prior to the advent of electronic computers is reviewed. Relevance of distribution sampling to simulation is disucssed; both these techniques use random numbers. Simulation is more difficult than distribution sampling due to lack of independence among time series, non-stationarity of the time series and the large numbers of parameters involved. (133 refs.).

732 Teichroew, Daniel and J.F. Lubin. COMPUTER SIMULATION: DISCUSSION OF THE TECHNIQUE AND COMPARISON OF LANGUAGES. Working paper No. 20, Graduate School of Business, Stanford University, Stanford, California, 27-29, 1964. Printed in Communications of the ACM, 9(10), 723-741.

> A general discussion of simulation as a technique, continuous-and discrete-change models, and evaluation of simulation languages.

733 Thayer, L.M., et al. SYSTEM DESIGN SPECIFICATIONS FOR THE SYSTEM TRAINING-PROGRAM, VOLUME I: - INPUTS AND SIMULATION MODELS, D (L) -3490/001/01, System Development Corporation, Santa Monica, California, January 1963.

734 Thielges, J.R. and W.G. Matheny. A REVIEW OF THE ANALYSIS OF VISUAL DISCRIMINATION IN HELICOPTER CONTROL. Paper read at meeting of SWPA, 1966 (Subcontractor: Life Sciences, Inc.): also issued as HumRRO Professional Paper 4-66, June 1966.

735 Thomas, Clayton. MILITARY GAMING. In: Progress in Operations Research, 1, 421-463. Wiley, New York, 1961.

> Tries to get at the essence of the subject through an inquiry into the development of the major modes of gaming; the history of gaming; examples of present military-gaming applications; details of major families of applications that cluster about the classic three-team war game, the large computer simulation model, the mathematical theory of games, and laboratory simulation. A discussion of the validity of the multivarious gaming applications.

736 Thomas, Clayton J. and Walter L. Deemer, Jr. THE ROLE OF OPERATIONAL GAMING IN OPERATIONS RESEARCH. Operations Research, 5(1), 1-27, 1957.

A detailed analysis of operational gaming, and how it is different from, and similar to, analytic game-theoretic approaches.

737 Thomas, L. Jean, (Ed.). A BIBLIOGRAPHY OF REPORTS ISSUED BY THE BEHAVIORAL SCIENCES LABORATORY: ENGINEERING PSYCHOLOGY, . . . SIMULATION TECHNIQUES. . . 657th Aerospace Medical Research Laboratories, Behavioral Sciences Laboratory, Wright-Patterson Air Force Base, Ohio, 1962.

This bibliography lists, by functional groupings, the technical reports, technical notes, contractor reports, memorandum reports, and journal articles prepared by the Behavioral Sciences Laboratory, and its contractors, from 1945 through 1961.

738 Thomas, Owen F. ANALOG - DIGITAL HYBRID COMPUTERS IN SIMULATION WITH HUMANS AND HARDWARE. In: Proceedings of the Western Joint Computer Conference, 1961. Western Joint Computer Conference, 1961.

A description of how an analog-digital hybrid computer was put to work at the U.S. Naval Ordnance Test Station, Pasadena, in the simulation center. Antisubmarine torpedoes and the associated fire-control equipment is tested by this method.

739 Thomas, Ralph, et al. THE EFFECT OF VARIOUS LEVELS OF AUTOMATION ON HUMAN OPERATORS' PERFORMANCE IN MAN-MACHINE SYSTEMS. USAF WADD Technical Report 60-618, 1961.

This report describes a method for generating definitive data on the effects of various levels of automation on human operators' performance in man-machine systems. The method incorporates a model and equipment for theoretical and experimental investigations. Equipment was designed and built in accordance with the assumptions of the automation model for studying human performance in an automation environment. Functions to be controlled are generated by a general-purpose analog computer. Pilot experiments have demonstrated that the equipment is suitable and that the model adequately describes automation problems. Significant effects of various levels of automation were demonstrated in some of the experiments.

740 Thompson, George. GAME THEORY AND "SOCIAL VALUE" STATES. *Ethics*, 75(1), 36-39, 1964.

This article is a reply and criticism of Robert Paul Wolff's position as outlined in "Reflections on Game theory and the nature of value", which appeared in *Ethics* in April, 1962 (vol. 72). Thompson takes the position that Wolff has "overlooked that the game model provides a criterion for judging a "good" or "rational" choice independently of whether the game is expected to end in victory or must not. . . the wish to keep a game going without victory does not in itself exclude the game as a model."

741 Thorelli, Hans B. GAME SIMULATION OF ADMINISTRATIVE SYSTEMS. In: *Marketing and the computer*, Wroe Alderson and Stanley J. Shapiro, (Eds.) Prentice-Hall, 334-348, 1963.

INTOP (International Business Operations Game), described in this article, was designed for use in tackling some of the problems of business planning. The game attempts to relate to the design and testing of organizational structure, information requirements in decision-making, and to the coordination of business fucntions.

742 Thorelli, Hans B. INTEGRATED USE OF SIMULATIONS IN MANAGEMENT EDUCATION. *Personnel Journal*, 43(2), 67-71, 1964.

The practicability of effective integration of simulation with other educational tools is illustrated by two sample courses, "Advanced Marketing Management," and "Business Policy and Organization."

743 Thorelli, Hans B. AN INTERNATIONAL BUSINESS OPERATIONS GAME. *Data Processing*, 4(10), 22-27, 1962.

This article describes a new management game called INTOP that has been developed by the University of Chicago. It appears to be quite complex, with many parameters. The article explains the game; the game was written for UNIVAC 1 - III. This game can be used as a management training device.

744 Thorelli, Hans B. and Robert L. Graves. INTERNATIONAL OPERATIONS SIMULATION: WITH COMMENTS ON DESIGN AND USE OF MANAGEMENT GAMES. Free Press, New York, 1964.

In this book, Thorelli and associates develop the INTOP proceedings which had been outlined earlier in journal publications.

745 Thorndike, Robert L. RESEARCH PROBLEMS AND TECHNIQUES. Research Report No. 3, Aviation Psychology Program, Army Air Forces, Washington, D.C., 1947. (AD-651779).

Contents: Job analysis problems and procedures; Invention and refinement of aptitude test forms; Problems in determining an adequate criterion; Determining the validity of single tests; Obtaining composite aptitude scores; Problems associated with reliability and reliability determination; Problems in correlation analysis; Sources and control of error in test scores; Training experiments.

746 Tocher, K.D. THE ART OF SIMULATION. Van Nostrand, Princeton, New Jersey, 1963.

This book is one volume in a series of texts in electrical engineering; this particular volume deals with the study of industrial operations and processes using large-scale data-processing and computer systems as simulators.

747 Tocher, K.D. REVIEW OF SIMULATION LANGUAGES. Operational Research Quarterly, 16(2), 189-217, 1965.

Nine popular computer simulation languages (GPSS, SIMPAC, SIMSCRIPT, SIMULA, CSL, ESP, GSP, MONTECODE, SIMON) are contrasted with each other, and with idealized requirements. No specific recommendations for language selection are made. The author points out that a user choice of language is normally limited by computer implementation. If a choice exists it should be guided by the necessity for occasional or sustained use. Occasional users require a simple language that is easy to understand and learn; sophisticated users require a more complex language. (25 refs.)

748 Tomkins, S.S. and S. Messick. COMPUTER SIMULATION OF PERSONALITY. Wiley, 1963.

A number of authors contributed to this volume: The interrelationships between affect, memory, thinking, perception and action, by Tomkins; Donald MacKinnon on Simulation of cognitive and innate affects or simulation of personality; Ernest Hilgard on the simulation of affects, images, and thoughts; Milton Rosenberg on Simulated man and the humanistic criticism; Programming people to simulate machines, by Gerald S. Blum; Computer simulation of a neurotic process, by Kenneth Mark Colby; and Motivational models in the simulation of neurosis, by Jerome L. Singer.

749 Topmiller, D.A. A FACTOR ANALYTIC APPROACH TO HUMAN ENGINEERING ANALYSIS AND PREDICTION OF SYSTEM MAINTAINABILITY. Doctoral dissertation, Ohio State University, 1964. Dissertation Abstracts, 25, 8, 4837 (Abstract), 1965.

"... treats systems measurement and prediction as a components of variance model. The sources of variation are identified as inter- and intra-man variation; machine variation, and man-machine interaction variation. A restricted case of the formulation was empirically investigated ... .

750 Torgersen, P.E. and G.B. Thomas. SIMULATING AN ACCEPTANCE SAMPLING PLAN. Industrial Quality Control, 20(6), 27-29, 32, 1963.

A business game is described which can be played in only an hour and yet it still permits the participants to see an ongoing sampling plan in action. It has been used to introduce the concept of acceptance sampling.

751 Tou, Julius and Richard H. Wilcox, (Eds.). COMPUTER AND INFORMATION SCIENCES, COLLECTED PAPERS ON LEARNING, ADAPTATION AND CONTROL IN INFORMATION SYSTEMS. Spartan Books, 1964.

This book contains the papers presented at the first Computer and Information Sciences Symposium held at Norhtwestern Technological Institute, Evanston, Illinois, in 1963. Artificial intelligence, and aspects of man/machine systems, were two areas included in this symposium.

752 Tracey, W.R., E.B. Flynn, Jr. and C.L.J. Legere. SYSTEMS APPROACH GETS RESULTS. Training in Business and Industry, 4(6), 17-21, June 1967.

> The article outlines Project MINERVA which was designed to train personnel more precisely for technical duties while shortening training time, lowering overall training costs, and reducing the number of instructors and support personnel. A ten stage system design was used to work toward three major objectives: (1) Establishing training requirements, (2) Developing the training system, and (3) Validating the training system. Results indicate that the system works well, and it is being up-dated and revised as necessary.

753 Twelker, Paul A. CLASSROOM SIMULATION AND TEACHER PREPARATION. The School Review, 75(2), 197-204, 1967. (Adapted from paper originally entitled "Simulation Applications in Teacher Education" presented at the AERA, Chicago, February 1966. Also published in condensed form in The Education Digest, (In Press).

> A general discussion of the application of the classroom simulation technique to the problems of teacher preparation. Included is a description of a specific classroom simulation technique.

754 Twelker, Paul A. PROMPTING AS AN INSTRUCTIONAL VARIABLE IN CLASSROOM SIMULATION. Final Report, Title VII, Project No. 5-0950, Teaching Research Division, Monmouth, Oregon, December 1965. (also paper read at AERA Convention, Chicago, February 1966).

> Purpose was to investigate the effects of two types of prompts on learning and transfer of responses to problems of management and communication in a classroom simulation facility.
> Results indicate that giving prompts that guided subsequent responses made learning more efficient in terms of sessions required for learning, number of trials required to meet criterion and adequacy of the first response in training on each problem as compared with not giving the prompts. The presentation of prompts that helped identify stimulus features to be responded to in the simulation had no effect on learning or transfer. Implications were: (1) simulation may be a powerful vehicle for teaching

principles of instruction or classroom management and control because it supplies common referents; and (2) future classroom simulations need not require students to respond to simulated problems as though they had no principles on which to base their actions since presentation of standards of behavior has a positive effect on learning rate and in some case, transfer.

755 Twelker, Paul A. THE TEACHING RESEARCH AUTOMATED CLASSROOM (TRAC): A FACILITY FOR INNOVATIVE CHANGE. The Journal of the Association for Programmed Learning, in press. (Also available as a mimeographed paper from Teaching Research, Monmouth, Oregon).

This paper describes the physical layout of the Teaching Research Automated Classroom (TRAC) and some of the capabilities of the equipment presently in use. Also discussed some examples of the uses of TRAC.

756 Uhr, Leonard. "PATTERN RECOGNITION" COMPUTERS AS MODELS FOR FORM PERCEPTION. Psychological Bulletin, 60(1), 40-73, 1963.

This paper reviews computer simulations of pattern recognition to indicate their relevance as models of form perception. The different types of programs are discussed and compared, and an attempt is made to assess their relative abilities. An attempt is made to exhibit certain similarities underlying superficially different approaches. Various specific simulations are compared with models and suggestions in the psychological literature.

757 Uhr, Leonard, and C. Vossler. RECOGNITION OF A SPEECH BY A COMPUTER PROGRAM THAT WAS WRITTEN TO SIMULATE A MODEL FOR HUMAN VISUAL PATTERN PERCEPTION. Journal of the Accoustical Society, 33, 1426, 1961.

The program gave 100% success on words that had been presented to it for "training" purposes, and 100% success on words spoken by speakers different from those used in training. Results with alphabetic patterns, in which 5-, 10-, and 20- letter arrays were all learned to 100% success, suggest that larger arrays of spoken words may give similar results.

758 Uhr, Leonard, Charles Vossler and J. Uleman. PATTERN RECOGNITION OVER DISTORTIONS, BY HUMAN SUBJECTS AND BY A COMPUTER SIMULATION OF A MODEL FOR HUMAN FORM PERCEPTION. Journal of Experimental Psychology, 63, 227-234, 1962.

Human Ss, and a computer simulation program of a model for form perception, were examined for their behavior in learning to respond with the proper name for a pattern type over variant examples of the pattern. Various experiments were made, after which it was concluded that the model outperformed human Ss in all cases.

759 U.S. Air Force. MINUTES - 25th AIR DIVISION DRIVER EDUCATION PROGRAM. 337th Fighter Group, Portland International Airport, Portland, Oregon, December 1961.

760 U.S. Forestry Service, FIRE CONTROL SIMULATOR. U.S. Department of Agriculture, Forest Service, Washington, D.C., February 1963.

A four page pamphlet describing the Forest Fire Control Simulator developed in 1962 by the Division of Fire Control of the Forest Service, Department of Agriculture, working with I T T of Paramus, New Jersey, Debriefing section, p.3.

761 University of Colorado. ROLE PLAYING SIMULATION IN INSTRUCTION. A tape recording of conference held by the Department of AV Instruction at its annual convention in 1966. Available: Tape Duplicating Service, National Tape Repository, University of Colorado, Boulder, 80304.

762 University Council for Educational Administration. SIMULATION IN ADMINISTRATIVE TRAINEES. UCEA, Columbus, Ohio, 1960.

763 University of Texas. THE SMALL BUSINESS EXECUTIVE DECISION SIMULATION: OPERATING MANUAL. Bureau of Business Research, Austin, Texas, 1963.

Detailed instructions for participants in the exercise.

764 Utsey, J. SIMULATION IN READING. Paper read at National Reading Conference, Miami, Florida, December 1966.

Film simulations were used to help train student teachers in the use of the Informal Reading Inventory to assess a child's reading level. Concludes that simulation may be a powerful tool for establishing or developing referents common to instructors and student teachers through observation (by film) of a specific instance or set of instances.

765 Utsey, J., C. Wallen and H.O. Beldin. SIMULATION: A BREAKTHROUGH IN THE EDUCATION OF READING TEACHERS. Phi Delta Kappan, 47, 572-574, June 1966.

Describes the procedure for using the Informal Reading Inventory Instructional Process materials (films and printed matter) to train teachers in the use of the informal reading inventory to assess a child's reading level. Preliminary test results indicate that this method allows students to assess reading levels with more accuracy than teachers with an average of 11.6 years experience (92% vs 70% respectively). "Carry-over" had not been completely evaluated but preliminary results indicate positive results.

766 Vance, Stanley. MANAGEMENT DECISION SIMULATION, A NONCOMPUTER BUSINESS GAME. McGraw-Hill, 1960.

> This game was developed to provide a practical management development device. Despite certain limiting features, simulation in decision making provides a novel and stimulating technique for discovering and maximizing leadership potential.

767 Vandermeer, A.W. SYSTEM ANALYSIS AND MEDIA -- A PERSPECTIVE. Audiovisual Communication Review, 12(3), 292-301, 1964.

> A description of how operations analysis can be applied to school systems. Models of school systems, including the aspect of instructional media, can be constructed.

768 Vazsonyi, A. ELECTRONIC SIMULATION OF BUSINESS OPERATIONS (THE MONTE CARLO METHOD). Presented to Second Annual West Coast Engineering Management Conference, Los Angeles, California, May 27-28, 1957.

769 Videbeck, R. and H. Bates. VERBAL CONDITIONING BY A SIMULATED EXPERIMENTER. Syracuse University, Syracuse, New York, prepared in cooperation with Missouri University, Contract nonr-229602, 1965.

> The present study sought to control for absolute consistency in experimenter behavior and reaction to the subject's verbal emissions. To attain this end, a computer was programmed to simulate the functions of the experimenter. Not only were the instructions to the subject and the experimental stimuli presented in a standardized manner, but invariance in the reinforcing operations was attained. The computer was programmed to recognize the preselected response class and reinforce it with the typed message "very good". The result is a highly replicable and consistent presentation of stimuli and reinforcement.

770 Vivian, Charles. SCIENCE GAMES FOR CHILDREN. Sterling, New York, 1963.

771 Vlcek, C.W. ASSESSING THE EFFECT AND TRANSFER VALUE OF A CLASSROOM SIMULATOR TECHNIQUE. Michigan State University, Title VII, NDEA Grant No. 7-32-0410-264 (Ed.D. dissertation project), 1965.

772 Vlcek, C. CLASSROOM SIMULATION IN TEACHER EDUCATION. Audiovisual Instruction, February 1966.

A classroom simulator was used to test the effectiveness of a simulation technique as compared to conventional instruction. Post-tests for both groups were new simulation materials. Trained observers found no significant difference between the experimental and control groups in terms of awareness of problems, or in effectiveness in responding to the problems. There were significant differences in the application of principles used in solving classroom problems. Low reliability between raters and limited return of the observation data limit the significance of the findings.

773 Vossler, Charles and Leonard Uhr. COMPUTER SIMULATIONS OF A PERCEPTUAL LEARNING MODEL FOR SENSORY PATTERN RECOGNITION, CONCEPT FORMATION, AND SYMBOL TRANSFORMATION. Paper presented at International Federation of Information Processing Societies, Munich, North Holland Publishing Company, 1962.

The problems stated in the title are reduced by the authors to the finding of transformation rules leading from a sequence of source data to a sequence of target data. In the simulated model transformation rules are built up and weighted during a learning mode according to success or failure, which is indicated by external teaching. Some figures are given concerning the error rate of the model using optical patterns and simple sentences of natural languages as examples. No information is provided on how efficient handling of transformation rules is achieved.
The interesting case where the data to be correlated are not cleanly separated but stem from the same source, i.e. the problem of context, is discussed in general terms.

K. Walk, Vienna, Austria

774 Vossler, C. and L. Uhr. A COMPUTER SIMULATION OF PATTERN PERCEPTION AND CONCEPT FORMATION. Bionic Symposim, 1962. In: Biological prototypes and synthetic systems, 1. E.F. Bernard and M.R. Kare, (Eds.). Plenum Press, 1962.

A general method for efficient discovery, learning and self-construction by a computer is presented. The problem posed on the computer is the problem of coming to know and to understand, in order to cope effectively with, the world that impinges upon it. The evolution, learning, behavior and purposes of brains, and, in fact, any of the systems studied by psychology and biology should be so examined. That is, living systems change toward better functional knowledge of the underlying patterns in the world as they know it. They therefore are specific, more or less defective, embodiments of general laws of information discovery and learning, in the same sense that specific systems of physical entities -- for example, impure compounds, suspension bridges, and solar systems -- are specific embodiments of general laws of physics.

775 Wagner, G., et al. BUILDING LISTENING SKILLS WITH INSTRUCTIONAL GAMES. Teachers Publication, Darien, Connecticut, 1962.

776 Wagner, Guy and Max Hosier. READING GAMES: STRENGTHENING READING SKILLS WITH INSTRUCTION GAMES. A Grade Teacher Publication. The Educational Publishing Corporation, Darien, Connecticut, 1960.

> Games offer children an approach to learning not usually found in the systematically organized reading instruction period. The suggestion is made that games have "built-in" incentives for successful achievement. Games in this book can be played by a class, a small reading group of similar abilities, or by an individual child with a teacher or pupil helper.

777 Wagner, G., et al. STRENGTHENING LANGUAGE SKILLS WITH INSTRUCTIONAL GAMES. Teachers Publication, Darien, Connecticut, 1963.

778 Wagner, G., et al. STRENGTHENING READING SKILLS WITH INSTRUCTIONAL GAMES. Teachers Publication, Darien, Connecticut, 1960.

779 Wagner, Guy. WHAT SCHOOLS ARE DOING: USING CHALLENGING LEARNING ACTIVITIES. Education, 86(6), 379-381, 1966.

> Games are an example of a learning activity which is making school life more challenging and meaningful for children.

780 Walker, Crayton C. A STUDY OF A FAMILY OF COMPLEX SYSTEMS: AN APPROACH TO THE INVESTIGATION OF ORGANISMS' BEHAVIOR. Dissertation Abstracts, 26(5), 2863, 1965.

> This paper describes the detached behavior of a theoretically basic complex system, using computer simulation. Particular emphasis is given to temporal characteristics of behavior important in the study of adaptive processes.

781 Walker, S.H. THE QUARTERMASTER SIMULATION. Report of System Simulation Symposium. D.G. Malcolm, (Ed.) Waverly Press, Baltimore, 99-106, 1957.

This paper discusses a simulation -- more exactly a series of simulations -- of the Army Supply Control System as it applies to sized clothing items. The simulations are programmed for the 1103 computer (Univac Scientific). The first runs were made in July and August, 1955, and the programs have been in steady use since then as experimental tools for solving problems in sized item supply control.

782 Wallen, C.J. DEVELOPING REFERENTIAL CATEGORIES WITH INSTRUCTIONAL SIMULATION. Paper read at AERA Convention, Chicago, February 1966.

General discussion of the need to teach teachers how to differentiate reading deficiencies of various youngsters and on the use of simulation as a tool to help build "referential categories" for the purpose of differentiating reading problems.

783 Ward, Lewis B. THE USE OF SIMULATION OF BUSINESS PROBLEMS. Management Record, 22(6), 30-33, 1960.

Part of the report of a 1960 Round Table Discussion sponsored by the Conference Board, called "Latest Developments in Human Relation", this article describes the research approach of simulation as one in which the individuals who are participating are removed from their job settings and given experiences that simulate different aspects of their jobs.

784 Webb, J.S., J.E. Willis and R.D. Anderson. A SELECTED ANNOTATED BIBLIOGRAPHY ON COST-EFFECTIVENESS AND MAN/MACHINE FUNCTION ALLOCATION. U.S. Naval Personnel Research Activity, San Diego, California, Research Memorandum, SRM 66-4, August 1965.

"This bibliography was prepared as the first part of an effort in which the feasibility of developing a general cost-effectiveness formula is being examined. The major areas of interest represented in this bibliography are: (A) SYSTEM COSTS, including a representative sample of factors which would relate to them. (B) SYSTEM EFFECTIVENESS, including reports which concern the cost-effectiveness ratio. (C) MAN/MACHINE FUNCTION ALLOCATION." There are 103 items listed.

785 Weil, Roman L., Jr. THE N-PERSON PRISONER'S DILEMA: SOME THEORY AND A COMPUTER-ORIENTED APPROACH. *Behavioral Science*, 11(3), 227-234, 1966.

The two-person, two strategy prisoner's dilemma is well known. The purpose of this research is to start an investigation of the more interesting multiple-strategy analog of the prisoner's dilemma. Four interpretations of the game are possible. Each of these is presented and one is selected for further study. The rationale for a combined laboratory-computer approach is given, some decision-making models for the game are constructed, and the results of the simulations of the models are reported.

786 Weiner, M.G. AN INTRODUCTION TO WAR GAMES. The Rand Corporation, P-1773, August 17, 1959.

787 Weinstock, J.K. AN INVENTORY CONTROL SOLUTION BY SIMULATION. *Report of System Simulation Symposium*. D.G. Malcolm (Ed.). Waverly Press, Baltimore, 65-71, 1957.

This paper describes a simulation of the replenishment cycle for restocking a branch warehouse, incorporating all the necessary statistical fluctuations and relationships.

788 Weiss, Doyle L. SIMULATION FOR DECISION MAKING IN MARKETING. *Journal of Marketing*, 28(3), 45-50, 1964.

Simulation is an approach to problem solving which has as its focus the construction and study of computer models as descriptions of the problem being analyzed. Its usefulness in marketing comes from the fact that problems too complicated for analysis by conventional methods may be solved.

789 Weizenbaum, J. ELIZA - A COMPUTER PROGRAM FOR THE STUDY OF NATURAL LANGUAGE COMMUNICATION BETWEEN MAN AND MACHINE. Communications of the ACM, 9(1), 36-43, January 1966.

Description (in general) and discussion of the computer program ELIZA which breaks down natural language statements through the use of key words and then reassembles statements based on the key words and reassembly rules which are used as replies to the person "talking" with the computer.

790 Whittier, J.R. METHODS FOR THE EVALUATION OF RESEARCH PRODUCTIVITY: A METHOD FOR EVALUATION OF RESEARCH PUBLICATION PRODUCTIVITY. Creedmoor Institute for Psychobiologic Studies, Queens Village, New York, 1966.

The report presents certain Categories of Research Productivity, and offers a method for the evaluation or assessment of one of these categories, that of production of reports published in scientific literature. The categories are treated under two headings, "Generating Productivity" and "Emitting Productivity".

791 Wickelgren, Wayne A. A SIMULATION PROGRAM FOR CONCEPT ATTAINMENT BY CONSERVATIVE FOCUSING. Behavioral Science, 7(2), 245-247, 1962.

This is a summary of an information-processing model for conservative focusing in a concept-attainment task, based on the work of Bruner, Goodnow, and Austin, 1956. The results of this study pointed up that the model probably forgets less often than normal human subjects do; the model never codes an attribute incorrectly or remembers it incorrectly, (the program either remembers correctly whether an attribute was determined to be relevant, or it does not remember at all); and, the model never offers an incorrect hypothesis before it possesses complete information, and human subjects sometimes do this. Suggestions for modification of the program are offered.

792 Wickman, Charles R. DIGITAL TRAINING DEVICES. In: Advances in computers, 6, 89-130. Franz Alt and Morris Rubinoff, (Eds.) Academic Press, 1965.

The advent of complex man/machine systems has resulted in an increasing emphasis being placed on the adequate training of personnel required for system operation and control. This training requirement has, in turn, led to the development of man/machine systems, especially designed for training, that effectively duplicate the functional environment to which the trainee will be exposed in the operational system. These systems, generally called training devices, have evolved in complexity and sophistication so that at times they rival the complexity of the operational systems.

793 Wikstrom, Walter S. THE SERIOUS BUSINESS OF BUSINESS GAMES. Management Record, 22(2), 6-8, 24-25, 1960.

In today's use of the business game, there seems to be less game and more business, as this evaluation of what the games can and can't do points out.

794 Wilkinson, R.K. and G. Mills. THE USE OF A BUSINESS GAME IN MANAGEMENT TRAINING. Journal of Industrial Engineering, 16(4), 282-285, 1965.

A simple business game is described and some observations made concerning the reactions of the players in executive training sessions. Some further comments are made concerning realism and transfer in such games. (8refs.)

795 Willis, J.E. and A.N. Dow. QUANTIFICATION OF PERSONNEL PERFORMANCE FOR COST EFFECTIVENESS DECISIONS: I. AN ANNOTATED BIBLIOGRAPHY. Research Memorandum SRM 67-15, U.S. Naval Personnel Research Activity, San Diego, California, April 1967. 60pp. (AD 650 933).

Selected articles about the prediction of personnel performance effectiveness. Five major areas are covered: (1) Personnel performance effectiveness measurement, (2) Personnel performance effectiveness prediction, (3) Human reliability in systems, (4) Personnel performance data utilization problems, and (5) Function allocation. Included are articles relevant to human factors application, man-machine systems, operations research, simulation, personnel performance standards.

796 Willis, Richard H. and Myron L. Joseph. BARGAINING BEHAVIOR. I. "PROMINENCE" AS A PREDICTOR OF THE OUTCOME OF GAMES OF AGREEMENT. Journal of Conflict Resolution, 3(2), 102-113, 1959.

A test of the notion of "prominence" as a major determinant of bargaining behavior under conditions of very limited communication is described.

797 Willis, Richard H. and Norma J. Long. AN EXPERIMENTAL SIMULATION OF AN INTERNATION TRUEL. Behavioral Science, 12(1), 24-32, 1967.

A simple experimental simulation was conducted of a three-sided internation conflict situation (i.e., a "truel"), in which each nation was represented by one S. On each of up to 50 trials, each S made a trichotomous decision not to attack, to attack the first of the others, or to attack the second of the others. To be attacked was to be eliminated, but a victim had the opportunity to make one more decision after being attacked. A 2 x 2 x 2 orthogonal design was employed in which the independent variables were (1) knowledge of source of attack, (2) knowledge of maximum number of trials, and (3) sex of Ss. Three groups were run in each of the eight conditions, making 24 groups and 72 Ss. Among the results it was noted that attacks occurred in 75% of the groups. An initial attack was invariably followed by at least one additional attack on the next trial or two. Fully 90% of all initial attacks occurred during the first five trials, and almost one-half occurred on the second trial alone. There was a pronounced and highly significant interaction between experimental conditions and strategies adopted by individual Ss as these jointly determined the chances of survival. Results are discussed in terms of hypotheses suggested concerning the outcomes of interperson, intergroup, or internation truels.

798 Wilson, Allan N. USE OF A COMBINED ANALOG-DIGITAL SYSTEM FOR RE-ENTRY VEHICLE FLIGHT SIMULATION. In: Computers -- Key to total systems control, 20, 105-113. Washington, D.C.: Proceedings of the Eastern Joint Computer Conference, Macmillan Company, New York, 1961.

Simulation of the re-entry phase of space flight for a vehicle on a satellite or lunar mission is being done at General Dynamics/Astronautics on its combined analog-digital system. Vehicle dynamics are simulated in real time on a large general-purpose analog computer, while an on-board digital guidance computer is simulated by digital program on a high-speed digital computer. This paper presents problems of computer system control, check-out procedures, synchronization, sources of error, and the results of the simulation.

799 Wilson, Atholl L. AN OPTIMAL STRATEGY FOR REPEATED N-PERSON GAMES. Behavioral Science, 8(4), 312-316, 1963.

In the past, the development of two persons zero-sum games has differed radically from that of n-person theory. One reason for the divergence is than n-person games have been investigated largely in terms of Von Neumann theory, in which the two-person zero-sum game reduces to an uninteresting special case. Another reason is that to the extent it has been possible to generalize the important results of two-person zero-sum theory, the generalizations have not appeared very fruitful. In this paper, a program will be outlined for achieving such generalization. Not all parts of the program have as yet been completed in a satisfactory way.

800 Wilson, Frank C. SIMULATION: GOOD WAY TO CUT RISKS IN MANAGEMENT DECISIONS. Textile World, 114(8), 60-63, 1964.

One of the newest mathematical techniques being used to cut risks in managing mills today is simulation. In this article, a description is given of how simulation can be used in a tufted-carpet mill -- how, in fact, it can set up a comparison of two yarns. It's a procedure which can be applied to any yarns and fabrics that the manufacturer may make.

801 Wilson, R.V. and V.E. Bixenstine. FORMS OF SOCIAL CONTROL IN TWO-PERSON, TWO CHOICE GAMES. Behavioral Science, 7(1), 92-102, 1962.

In this paper, the importance of power as an influence on choice of strategies is analyzed; and the application of game theoretic concepts to real-life social conflicts is discussed. In mixed-motive games, the amount of control which a player can exercise over his own and his opponents' gains and losses obviously has an important influence on choices of strategy for both.

802 Winder, R.O. THRESHOLD LOGIC IN ARTIFICIAL INTELLIGENCE. IEEE Publication S-142, Artificial intelligence (a combined preprint of papers presented at the winter general meeting, 1963), 107-128, 1963.

803 Winestone, R.W. COST AND PERFORMANCE DATA FOR LP-1: THE FIRST EXPERIMENT IN SIMULATION BY THE LOGISTICS SYSTEMS LABORATORY. The RAND Corporation, RM-2200, July 9, 1958.

804 Wing, R.L. COMPUTER-CONTROLLED ECONOMICS GAME FOR THE ELEMENTARY SCHOOLS. *Audiovisual Instruction*, 9, 681-682, 1964.

> A description of the Sumerian Game, developed to teach sixth-graders some basic principles of economics in operation at the time of the neolithic revolutions in Mesopotamia.

805 Wing, R.L. TWO COMPUTER-BASED ECONOMICS GAMES FOR SIXTH GRADERS. *American Behavioral Science*, 10(2), Part II, 31-36, 1966.

806 Wing, R.L. USE OF TECHNICAL MEDIA FOR SIMULATING ENVIRONMENTS TO PROVIDE INDIVIDUALIZED INSTRUCTION. Board of Cooperative Educational Services, Westchester County, Bedford Hills, New York.

807 Wittrock, M.C. DECISION MAKING IN SIMULATED TEACHING SITUATIONS. In: *The Automation of School Information Systems*: Monograph I, Division of Audiovisual Instruction, National Education Association, 1964.

808 Wolff, Robert Paul. REFLECTIONS ON GAME THEORY AND THE NATURE OF VALUE. *Ethics*, 72(3), 171-179, 1962.

> This paper concentrates its attention on the analysis of the *kind of value* which game theory assumes is to be maximized by rational strategies.

809 Wolfle, D. THE USE AND DESIGN OF SYNTHETIC TRAINERS FOR MILITARY TRAINING. Office of Scientific Research and Development, Report 5246, 1945.

810 Wright Air Development Division. USE OF TASK ANALYSIS IN DERIVING TRAINING AND TRAINING EQUIPMENT REQUIREMENTS. Training Psychology Branch, Behavioral Sciences Laboratory, December 1960. 61pp. (AD 252 946).

> The requirements for and uses of task information in developing requirements for training equipment are discussed in a series of seven papers by the human factors subcontractors involved in the development of three complex electronic reconnaissance systems.

811 Wolin, Burton R. ARE THE MAN AND THE MACHINE RELATIONS? In: 1962 Spring Joint Computer Conference, AFIPS, 21, 139-145, 1962.

Humans are considered as general purpose computers. They ask two questions of the environment, "What is most likely to be the situation next?" and, "What do I do now?" A research program is described which seeks to determine how, and how well, humans can answer the former question or predict the environment.

812 Wyman, R. A NERVE NET SIMULATION. Behavioral Science, 7(2), 250-252, 1962.

This paper describes how certain different types of processing can be used to simulate more closely the factors which are probably crucial to real nerve synaptic decisions.

813 Wynn, Richard. SIMULATION: TERRIBLE REALITY IN THE PREPARATION OF SCHOOL ADMINISTRATORS. Phi Delta Kappan, 46, 170-173, 1964.

This article describes and analyzes the success of the more than 65 universities which have been using simulated materials for training school administrators since 1959.

814 Yett, Frank A. THE SIMULATION OF MANAGEMENT DECISIONS FOR PROFESSIONAL STAFF CONTROL. Journal of Educational Measurement, 2(1), 19-22, 1965.

The Management Decision Program for Professional Staff Control is a management technique for analyzing persistent problems of professional staff organization. The program can be used to simulate probable outcomes which are functions of personnel policies imposed by management, the training and experience of the staff, and the interaction of the two.

815 Young, John P. A SURVEY OF HISTORICAL DEVELOPMENTS IN WAR GAMES. ORO-SP-98, The Johns Hopkins University, Operations Research Office, Bethesda, Maryland, March 1959.

816 Yovits, M.C., G.T. Jacobi and G.D. Goldstein, (Eds.) SELF-ORGANIZING SYSTEMS. Spartan Books, 1962.

This volume comprises the Proceedings of the Conference on Self-Organizing Systems held on May 22, 23, and 24, 1962 in Chicago, Illinois.
"A Self-Organizing System is a system which changes its basic structure as a function of its experience and environment".
Basic problems considered at the Conference revolved around the idea that "certain types of problems, mostly those involving inherently non-numerical types of information, can be solved efficiently only with the use of machines exhibiting a high degree of learning or self-organizing capability. Examples of problems of this type include automatic print reading, speech recognition, pattern recognition, automatic language translation, information retrieval, and control of large and complex systems. Efficient solutions to problems of these types will probably require some combination of a fixed stored program computer and a self-organizing machine."

817 Zelditch, Morris, Jr., and William M. Evan. SIMULATED BUREAUCRACIES: A METHODOLOGICAL ANALYSIS. In: *Simulation In Social Science: Readings*, Harold Guetzkow, (Ed.). Prentice-Hall, 1962.

A review of some of the functions of laboratory simulation, the principal considerations in constructing simulates, and a diagnosis of the dangers of simulation -- all in the context of a problem of sociological relevance, the creation of experimental bureaucracies.

818 Zellner, Arnold. WAR AND PEACE: A FANTASY IN GAME THEORY? *Journal of Conflict Resolution*, 6(1), 39-41, 1962.

A description of a game of world politics.

819 Zimmerman, Richard E. SIMULATION OF TACTICAL WAR GAMES. In: *Operations research and systems engineering*, Charles D. Flagle, William H. Huggins, and Robert H. Roy, (Eds.) The Johns Hopkins Press, Baltimore, Maryland, 711-762, 1960.

A description of the development of war gaming techniques for research purposes at all tactical levels as it has been pursued at the Tactical War Gaming Group at the Operations Research Office (of the Johns Hopkins University).

820 Zinser, Otto. IMITATION, MODELING, AND CROSS-CULTURAL TRAINING. Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, July 1966.

A study of the literature on imitation and modeling was conducted to aid in development of a modeling training technique to accelerate the acquisition of cross-cultural interaction skills. The modeling procedure is designed to provide exemplary behavior to the trainee via videotape recording. The literature review includes a summary of theoretical positions that have been formulated, a survey of research in terms of the variables that have been investigated, and a review of modeling techniques that have found application. A discussion devoted to implications for developing a cross-cultural training technique is also presented. The advantages and disadvantages of various procedures for constructing an effective modeling technique has to date not been used to aid in the acquisition of cross-cultural interaction skills. The report concludes with the recommendation that the effectiveness of such a training technique be evaluated.

821 Abt Associates, Inc. SIX DEMONSTRATIONS OF THE AGILE/COIN GAME. Cambridge, Massachusetts, August 1966.

822 Abt Associates, Inc. COUNTER-INSURGENCY GAME DESIGN FEASIBILITY AND EVALUATION STUDY. Cambridge, Massachusetts, 1965.

823 American Institute of Industrial Engineers. REPORT OF SYSTEM SIMULATION SYMPOSIUM. Waverly Press, Inc., Baltimore, 1958.

A report of the 8th National Convention of the American Institute of Industrial Engineers held in New York City, May 16 and 17, 1957. The purpose of the symposium was to develop common threads from various aspects of simulation activity (from management, industry, and the military), to assist in the matter of research communications and definitions, and to serve to illustrate an attractive new management technique.

824 Baker, Frank B. and Thomas J. Martin. AN IPL-V TECHNIQUE FOR SIMULATION PROGRAMS. *Educational and Psychological Measurement*, 25(3), 859-865, 1965.

A pseudo-code system with executable or non-executable routines and an associated recursive interpreter are proposed to avoid having to write unique instructions to handle the between routine communication of information. Although the scheme was developed for a particular simulation project, the approach used is thought to have general applicability in other areas of simulation.

825 Berkun, Hilton M., *et al*. HUMAN PSYCHOPHYSIOLOGICAL RESPONSE TO STRESS: SUCCESSFUL EXPERIMENTAL SIMULATION OF REAL-LIFE STRESSES. Research memorandum. Symposium presented at meeting of APA, December 1959.

This presentation deals with some of the theoretical aspects of, and two impirical situations of, simulated stress in combat. A review of the conceptualization of and research methodology involved in simulation of real life stress situations is also included.

826 Boguslaw, Robert, Robert H. Davis and Edward B. Glick. A SIMULATION VEHICLE FOR STUDYING NATIONAL POLICY FORMATION IN A LESS ARMED WORLD. Behavioral Science, 11(1), 43-61, 1966.

Problems of predicting the future under unknown or unanticipated social and psychological conditions involve basic issues in the processes of negotiation behavior, such as: If a particular course of action is adopted, how will the environment respond? Given the social pressures and human prejudices that are operative, what is possible? Would some other course of action be more productive for the nation as a whole or for some particular interest groups? A simulation vehicle and supporting experiments to study these problems are presented.

827 Bureau of Business Research. SIMULATION TRAINING FOR SMALL BUSINESS EXECUTIVE DEVELOPMENT. The University of Texas, Austin, Texas, 1963.

This report is the second in a series describing the nature and the results of tests carried out with the small business executive decision simulation model constructed by a team of the staff of the Bureau of Business Research, the University of Texas.

828 Center for Research in Business. PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON MANAGEMENT GAMES. University of Kansas, 1959.

A report of the First National Symposium on Management Games. Included are papers and discussions on "Management games" and "Research aspects of management games", "Management games and the design of educational programs" also the article by W.R. Dill, "The research potential of management games" is included in the appendix, p. VI-2.

829 Chapanis, A. HUMAN ENGINEERING, IN OPERATIONS RESEARCH AND SYSTEMS ENGINEERING. C.D. Flagle, W.H. Huggins and R.H. Roy, (Eds.). The Johns Hopkins Press, Baltimore, 534-582, 1960.

This chapter covered some of the human factors involved in the design of automatic and semiautomatic machine systems. It demonstrated that there are still quite a few human problems in most such systems, and that a successful automatic system requires the engineer to consider carefully the role of the human operator and how he is designed into the system. Finally, it suggested why the human factors specialist is often considered a member of the systems design team, and in what ways he can contribute to the important and challenging task of designing new systems for our automatic world of tomorrow.

830 Christine, Charles and Dorothy Christine. SIMULATION, A TEACHING TOOL. The Elementary School Journal, 67(8), 396-398, May 1967.

831 Cohen, Kalman J. and Eric Rhenman. THE ROLE OF MANAGEMENT GAMES IN EDUCATION AND RESEARCH. Management Science, 7(2), 131-166, January 1961.

The paper is intended to be a broad survey of both the present and the potential role of management games in education and research. The authors give a brief history of business games, discuss differences between general and functional business games, present uses of management games as a teaching device are surveyed and evaluated, and some hypotheses regarding the relations between the design and administrative characteristics of a business game and its educational properties are also formulated. The concluding portion surveys the potential use of management games as a laboratory for business and social science research.

832 Cruickshank, Donald R. THE LONGACRE SCHOOL: A SIMULATED LABORATORY FOR THE STUDY OF TEACHING. University of Tennessee, College of Education, Knoxville, Mimeographed paper, no date.

The paper gives a brief overview of simulation and describe the simulation used to practice solving critical teaching problems which are presented through role plays, film, and in written incidents.

833 Cruickshank, Donald R. RELATED READINGS ON SIMULATION - A BIBLIOGRAPHY. University of Tennessee, College of Education, Knoxville, Mimeographed paper, no date.

A list of references on educational and business games and simulations, and references on game or simulation theory.

834 Flagle, Charles D. SIMULATION TECHNIQUES. In: Operations Research and Systems Engineering. Charles D. Flagle, William H. Huggins and Robert H. Roy, (Eds.) The Johns Hopkins Press, 1960.

An explanation and description of how, in operations research, an activity which is called in this article "simulation techniques" can be viewed as the counterpart of scale model testing in physical research and design. The parallels are explored in this study.

835 Green, Bert F., Chairman. SIMULATION OF PSYCHOLOGICAL AND SOCIAL PROCESSES: REPORT OF THE COMMITTEE. Social Science Research Council Items, 19(1), March 1965.

A description of work being done under grants of the Social Science Research Council on simulation programs with regard to certain cognitive processes (by Harry Gollob, Yale), and of a model for simulation of a neurotic process (by J. David Jackson, University of Chicago).

836 Haythorn, W.W. THE USE OF SIMULATION IN LOGISTICS POLICY RESEARCH. The RAND Corporation, P-1791, September 1959.

837 Haythorn, W.W. THE USE OF SIMULATION IN ESTIMATING INTRA-CONTINENTAL LOGISTICS REQUIREMENTS --DESCRIPTION OF LP-II, PHASE 1.1. The RAND Corporation, P-1656, February 1959.

838 Johnston, William A. and Leon H. Nawrocki. EFFECT OF SIMULATED SOCIAL FEEDBACK ON INDIVIDUAL TRACKING PERFORMANCE. Journal of Applied Psychology, 51(2), 145-151, 1967.

Individual tracking performance was examined under conditions of simulated social feedback. Each of 60 Ss was told he had a partner and that posttrial feedback represented their team performance relative to average tracking ability. Actually, S's feedback represented his individual performance relative to a lenient, moderate, or stringent criterion. These criteria simulated partners of varying ability. Ss blamed their contrived partners for poor scores received under the stringent criterion. Performance of good trackers was not affected by criterion difficulty, but poor trackers performed best under the moderate criterion. The inhibitory influences of the stringent criterion was magnified during a terminal extinction session. The results suggest that criteria difficulty is an important determination of performance in team and perhaps individual tasks.

839 Malin, David. CONTRANS (CONCEPTUAL THOUGHT, RANDOM-NET SIMULATION). In: Computer -- Key to total systems control. Proceedings of the Eastern Joint Computer Conference, Washington, D.C., 20, 124-134, December 1961.

CONTRANS is a computer simulation of a physiologically oriented reasoning and problem solving model.

840 Paulson, Casper F., Jr. AN EXAMINATION OF THE STRUCTURE AND EFFECTIVENESS OF SLIDE-TAPES PRODUCED BY RATIONAL ANALYSIS AND SELF-SEQUENCING TECHNIQUES. Teaching Research Division, Oregon State System of Higher Education, Final Report, Office of Education Grant No. 7-27-0000-238, Project No. 5-0952, Monmouth, Oregon, June 1967.

Two techniques for developing slide-tape presentations, from which teachers may learn to identify and construct behavioral objectives, were compared with respect to the structural characteristics, particularly sequencing, of the product each technique produced and the effectiveness of each in terms of achievement. The two techniques were rational analysis (RA) and self-sequencing (SS).
Treatment effects were similar to the two treatments. Treatment effects approached significance in favor of the SS technique but this variation was attributed to variations in sequence rather than the superiority of the SS technique.

841 Temp, George. THE INSTRUCTIONAL USE OF SIMULATION MATERIAL WITH SECONDARY EDUCATION STUDENTS IN EDUCATIONAL PSYCHOLOGY. University of California at Los Angeles, Teacher Education Project, Mimeographed paper, January 1963.

842 Temp, George. SIMULATION AND TEACHER EDUCATION. University of California at Los Angeles, Teacher Education Project, Mimeographed paper, September 1962.

843 United States Department of Commerce. HUMAN ENGINEERING -- PART VI. PERSONNEL TRAINING AIDS AND DEVICES, 1942-1958. Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, CTR-363, October 1958.

A bibliography of research studies using various personnel training aids and devices.

844 University Council for Educational Administration. SIMULATION IN ADMINISTRATIVE TRAINING. Columbus, Ohio, 1960.

845 University of Southern California. COMPUTER PERSONNEL SELECTION AND CRITERION DEVELOPMENT: III, THE BASIC PROGRAMMING KNOWLEDGE TEST. Technical Report 49, June 1966.

Test an individual's knowledge of the basic principles and techniques of programming. The University's report on the BPKT is one of a series on the criterion development phase of a long-term research program concerned with computer personnel selection and evaluation. The BPKT is intended to stand by itself as a criterion of programming proficiency. Test questions were selected meeting the criteria of discrimination and appropriate difficulty, as indicated by the statistical analysis of results of a large preliminary testing. The final form of the test consists of 100 multiple-choice questions that are designed to be free of references to specific computers and languages now in use. The BPKT was planned to meet three needs. It is an instrument to use for selecting experienced personnel. It provides a method to assist in classifying, evaluating, and upgrading programmers and analysts. And it is an objective, reliable research instrument to be used in validating aptitude tests or other predictors. . .

846 Wagner, L.W. and E.G. Palola. MINIATURE REPLICA MODEL AND ITS USE IN LABORATORY EXPERIMENTS OF COMPLEX ORGANIZATIONS. Social Forces, 42, 418-428, 1964.

847 Waldorf, Frank and James S. Coleman. ANALYSIS AND SIMULATION OF REFERENCE GROUP PROCESSES. Paper presented to Division 8, American Psychological Association, St. Louis, Missouri, August 31, 1962.

The paper describes work, using an electronic computer, which examines social influence processes as they operate in a loosely structured social system.

848 Gagne, Robert M. SIMULATORS. In: Training Research and Education. R. Glaser (Ed.) Science Editions, John Wiley and Sons, Inc., New York, 1965.

A highly competent discussion of simulation: its meaning, purposes, and implications for education.

E-BR
Meeat
EA

FROM:
ERIC FACILITY
SUITE 601
1735 EYE STREET, N. W.
WASHINGTON, D.C. 20006